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THESIS

MANAGEMENT CONTROL OF AVIATION FLEET MAINTENANCE FUNDS IN A STOCK FUND ENVIRONMENT

by

Richard John Gough

December 1984

Co-Advisors: Shahid Ansari
Frank Royer

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Management Control of Aviation Fleet Maintenance Funds in a Stock Fund Environment

by

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Submitted in partial fulfillment of the
requirement for the degree of

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ABSTRACT

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I. INTRODUCTION

A. GENERAL

In response to increasing demands and expectations of the general public concerning how its tax money is spent, legislators and government officials have become increasingly aware of the need for responsible and responsive financial management. They are concerned whether organizations are achieving their goals within the parameters of the law and whether attainment of those goals is accomplished in an efficient and economical manner. A process of management control enables management to achieve these objectives. [Ref. 1]

For many years the Department of the Navy has been engaged in efforts to improve management control practices at all organizational levels. An aim of this study is to advance this effort by a functional analysis of the system employed by the aviation Type Commanders to manage Aviation Fleet Maintenance (AFM) funds in relation to the stock funding of aviation depot level repairables (AV-DLRs).

B. OBJECTIVES

Aviation fleet maintenance funds are used for the purchase of repair parts and supplies consumed in the maintenance and support of the Navy's fleet of approximately 3329 aircraft, which are valued at approximately 25 billion dollars (priced

at original cost). The budgeted cost for the Type Commanders to provide AFM support for fiscal year 1983 was in excess of 285 million dollars. Under the stock funding of AV-DLRs this AFM figure will mushroom to an estimated 1.2 billion in fiscal year (FY) 1986 (Dillenburg, 1984). Historically, AFM funds have been sufficient for the requirements of organizational and intermediate level maintenance, and the existing control system for these funds, while subject to periodic criticism, has proven adequate. However, the stock funding of AV-DLRs on 1 April 1985 presents a new challenge. Stock funding promises to provide substantial economies for the Navy overall, yet the aviation Type Commanders and their subordinate units will soon be responsible for the management and control of substantially larger AFM grants to support this change. That is, the stock funding of AV-DLRs will require intensified management attention on the part of the Type Commanders as well as subordinate units, and it brings a requirement for a functional analysis of the viability of current control system in this new environment.

The objective of this thesis is to evaluate the AFM funds control system which is currently employed by the aviation type commanders and judge the impact of the stock funding of AV-DLRs upon this system. To accomplish this objective and to formulate recommendations for the improvement of AFM funds management, the following research questions are addressed:

1. Given a stock fund environment for AV-DLRs, does the AFM funds control system employed by the aviation Type Commanders meet generally accepted management control principles?

2. Are the existing financial control practices well adapted to the organizations current and future environment?

3. What changes are required to improve AFM budgeting and grant allocation?

4. What control tools can be employed to strengthen the AFM funds control process?

The following approach was taken in response to these research questions.

1. From a search of the literature, a set of principles of control were developed for use in the evaluation of the AFM funds control system.

2. The environment within which the AFM funds control system operates was defined.

3. A comparison was made of the AFM funds control system employed by the aviation Type Commanders to the ideal properties of good control system developed in step one (1) above.

4. The current AFM funds control system was analyzed to identify its relative strengths and weaknesses and to evaluate the potential impact of the stock funding of AV-DLRs upon it.

5. Solutions were formulated and presented based in this analysis for improvement of the AFM funds control system.

C. PRIOR AFM RESEARCH

Prior to the decision to stock fund AV-DLRs, previous studies by Reily and Sheppard (1980), Naval Audit Service (1981), and Bozin [Ref. 2], expressed the opinion that the management of AFM funds can and should be improved. The following is a partial summary of the significant findings of these studies which are germane to this thesis.

1. There is a lack of participation by the Type Commander and subordinate units in budget preparation (Reily and Sheppard, 1980).

2. There are no overall goals or specific objectives for AFM performance [Ref. 2].

3. The AFM cost collection procedures do not effectively collect or categorize aircraft maintenance expenses (Naval Audit Service, 1981).

4. The system fails to hold AFM managers accountable for anything other than R.S. 3679 violations (Reily and Sheppard, 1980).

Despite these findings, the current AFM funds control system remains essentially unchanged. However, the environment in which the AFM funds control system operates has not remained static. A renewed requirement exists for a reevaluation of the system in consideration of its new operating environment.

D. RESEARCH METHODOLOGY

This thesis relies primarily on a literature search of management control, budget management, and pertinent Navy Instructions and Directives, as well as an empirical analysis of the AFM funds control system.

The following methodology was used in the structuring of this thesis:

1. Information on management control and budgeting literature was gathered from a review of scholarly texts, management periodicals, and related AFM funds management studies. The information obtained became the theoretical foundation upon which the existing AFM funds management practices could be evaluated.

2. An analysis of the Navy's formal documentation and directives governing the management control of AFM funds was conducted.

3. The Navy's documentation pertaining to the stock funding of AV-DLRs was reviewed.

4. An analysis of the Navy's AFM funds control system in practice was accomplished. Data concerning AFM accounting, management, and operations was collected through the use of in-person interviews, telephone surveys, and field study.

E. THESIS ORGANIZATION

The organization and contents of this thesis are briefly summarized as follows:

Chapter II is a overview of management control theory which begins with a discussion of the concept of control. It then provides a management control framework for this study's approach to management control problems and concludes with some management control principles to be used in a functional analysis of the current AFM funds control system. Chapter III provides a comprehensive overview of the AFM funds flow and Chapter IV provides background information pertaining to the stock funding of AV-DLRs. In Chapter V the management control principles developed in Chapter II are used in an analysis of the existing AFM funds control system. A case study approach is used to provide findings and conclusions. Chapter VI presents the recommendations resulting from this study. Suggestions for additional study or research are included.

II. MANAGEMENT CONTROL THEORY

A. GENERAL

Before an analysis of the AFM funds control system employed by the aviation Type Commanders can be conducted, a conceptual understanding of fundamental management control principles is necessary. These principles once developed will form this basis for analysis. This Chapter will accomplish this through: (1) an introduction to theoretical control thought, (2) development of a set of management control principles, and (3) a discussion of special considerations for control in non-profit organizations.

B. CONCEPTS OF CONTROL

Control in the management sense is as old as organization itself. Aristotle stated in his disclosure Politics; "He who is unable to live in society or who has no need because he is sufficient for himself, must either be a beast or a god ...." As Aristotle implies, it is difficult if not impossible to exist outside of social relationships. Human association satisfies man's social needs. In addition, it amplifies human capacities through cooperative effort. "What one man can do, two can do; what one can do, two can do better" (Albers, 1961). Cooperative effort, however, involves some form of work division and whenever tasks are divided, some means is necessary to assure performance is conducted in a manner that will achieve the common goal.

It is generally accepted that control is an essential ingredient for effective management. However, the word "control" often evokes unpleasant images. It has been said "our whole concept of control is 'naive', 'primitive', and ridden with an almost retributive idea of causality. Control to most people is a crude process of coercion ..." [Ref. 3: p. 23]. Control, in the vocabulary of business, includes, among other things, these usages: production control, quality control, budgetary control, inventory control, internal control, and financial control. The common element in all of these is the word "control", yet each one is conceptually different (Dunlevy, 1965).

According to Anthony, Dearden, and Bedford [Ref. 4], underlying all control processes is the idea of directing a variable, or a set of variables, to a goal or objective, whether that variable is an individual, a machine, or an organization. Systems for control of these variables have been broadly classified by function, purpose, structure, or other criteria. However, authors such as Drucker (1964) and Kast and Rosenweig (1970) point out that management control may be viewed in two ways. One relates to the evaluation of desired physical outcomes and the making of corrections when necessary (structural perspective) and the other relates to the achievement of control over subordinates (behavioral perspective). Additionally, it has been suggested by Ansari (1977) that these structural and behavioral variables should be considered from an integrated perspective.

1. Structural Perspective

From a structural perspective the control system utilizes physical tools and techniques to ensure that the entity effectively and efficiently converts inputs to outputs. This generalized view of control not only can be found in organizational management control but also in the worlds of nature, science, and engineering. Ansari (1977) states that the physical or structural approach was first exemplified in the early work of cybernetics, where control is viewed as synonymous with the communication of information, and the system is viewed as composed of inanimate objects whose process are governed by the physical sciences. Koontz and O'Donnell [Ref. 5], suggest that critical to this view is the concept of information feedback, the process which discloses errors or deficiencies in goal attainment and feeds back this information to the system. The traditional example cited for a structural or physical system is the regulation of home heating and cooling through a thermostat. The problem for management under this view is to design a regulatory mechanism which will automatically respond to feedback regarding disturbances in its operating environment.

A diagram of a simple system is shown in Figure 2.1. It is assumed that the system acts upon the input to produce an output. In the absence of any inputs the production of outputs would cease.

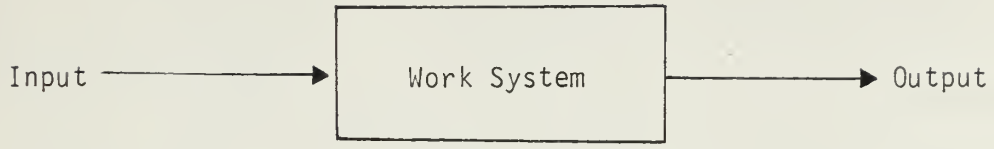

Figure 2.1 Simple System (Pava, 1983)

A structural approach further suggests that the entity can regulate many of its own activities through feedback. A simple control system is added to the system in figure 2.1 and is presented in Figure 2.2.

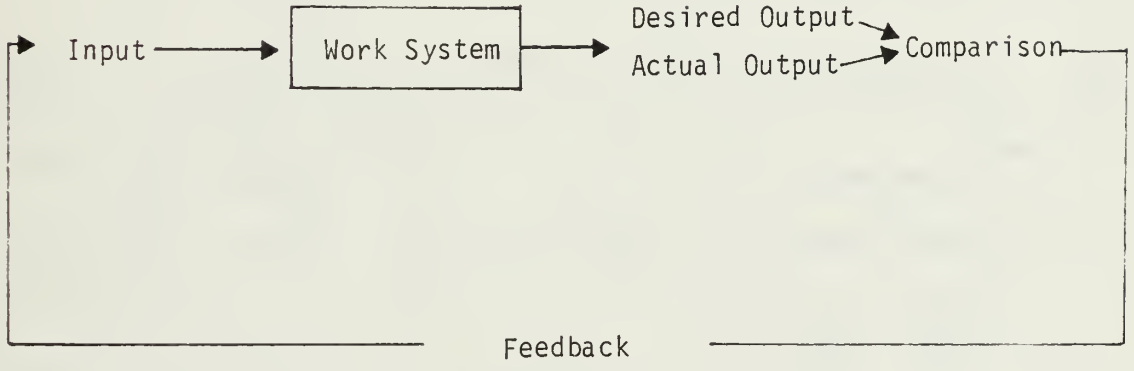

Figure 2.2 System Feedback (Pava, 1983)

In this diagram the output is measured relative to the input and the differences (or variances) become the new

or controlled input. Comparing and measuring are done automatically; the actual performance is compared with standard performance and the amount of variance shown. In this case the major task is not so much to find out whether there are variances, but to determine the meaning and measure the significance of the variances, and to take appropriate corrective actions.

Amand (1974), describes a physical model that considers multiple variables as well as other system disturbances. The model is reproduced in a diagram in Figure 2.3.

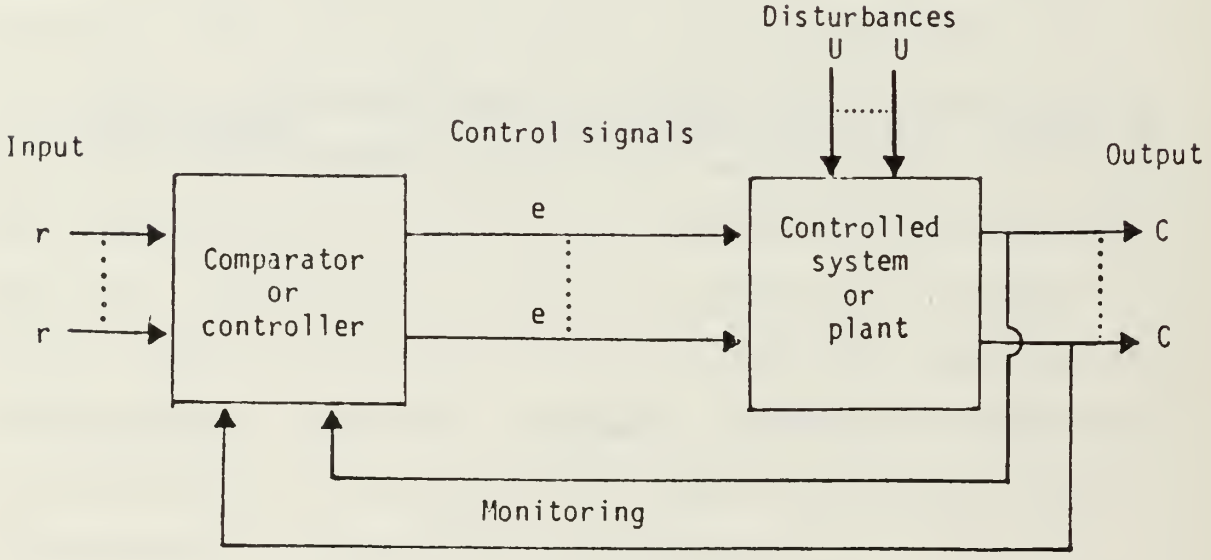

Figure 2.3 General Control System (Amand, 1974)

Although Amand's model considers a more complex relationship between variables, (i.e., multiple; inputs, control signals,

outputs, and monitoring, as well as disturbances from the external environment), the principle elements of the system remain unchanged.

While models of control systems vary in degree of sophistication, Anthony, Dearden, and Bedford [Ref. 4], suggest that all control systems used in organizations consist of four essential structural components:

1. An observation device (detector) that detects or observes and measures or describes the activities or other phenomena being controlled.

2. An assessing device (selector) that evaluates the performance of an activity or organization, usually relative to some standard or expectation of what should be, and identifies out-of-control activities and conditions.

3. A behavior modification device (effector) for altering or changing performance if the need for doing so is indicated.

4. A means for transmitting information among the above described devices.

Collectively, these components may be structured as a system, because they are a set of interrelated processes serving a common purpose. The interrelationship is that each component of the system affects and is affected by the other components. Figure 2.4 depicts the essential components of a control system.

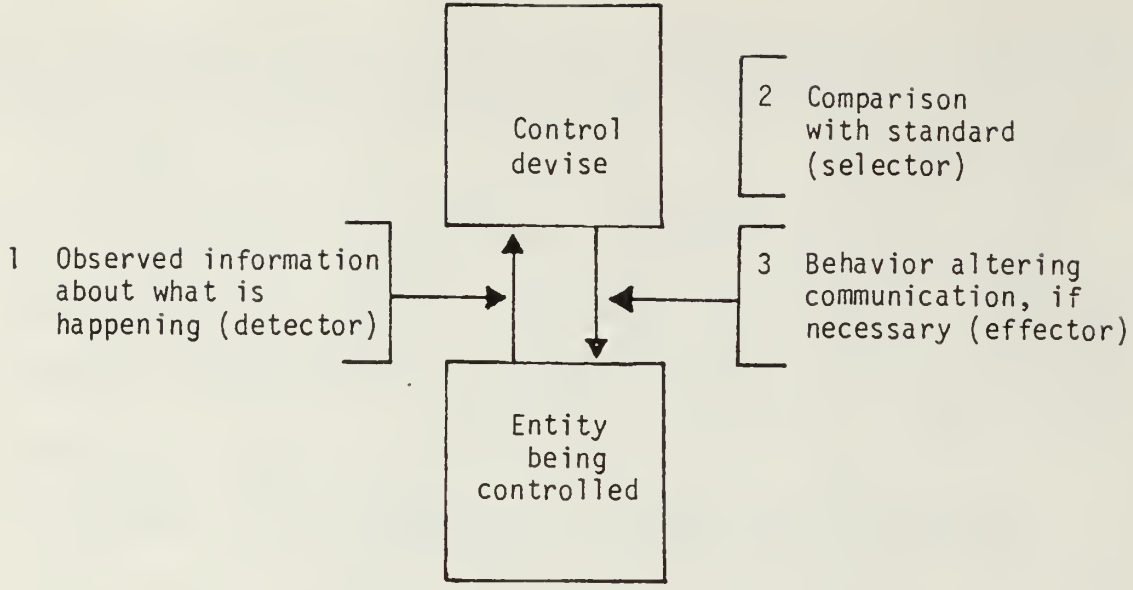
Control devise
2 Comparison with standard (selector)
1 Observed information about what is happening (detector)
3 Behavior altering communication, if necessary (effector)
Entity being controlled

Figure 2.4 Essential Components of a Control System [Ref. 4]

2. Behavioral Perspective

Control system designers characterize behavioral or social variables in different ways. This variation reflects the diversity of perspectives in the social sciences, where theory is more interpretative and less quantitative than it is in some of the physical sciences that form the basis for analysis of the structural perspective (Kaplan, 1964). Mockler [Ref. 6], states that the tools of behavioral science are important in any management control situation where people are involved. Without consideration of the behavioral factors which are found in the social system, the exercise of control would be reduced to a mechanical process which ignores human needs and the factors important in the motivation of human beings.

According to Ansari (1977), to regard human behavior as a random disturbance, as is proposed in a purely structural interpretation of control, is to deny the role of goal oriented behavior of humans in a control system. It cannot be assumed that by simply providing management the right information that control problems will be solved. It should be recognized that the behavioral climate within which the information is perceived may reduce its usefulness or even distort it. The consideration of behavioral factors in control systems design can enable managers to take appropriate action to correct deviations from performance standards. A behavioral approach however, goes beyond correction of deviations, in that it requires the control system to engage members to sustain high performance. It attempts to achieve this by designing features into the control system that evoke continuing high commitment (Pava, 1983).

3. Integrated Perspective

Ansari (1977) states that researchers interested in the development of control systems have historically focused on either a structural or a behavioral perspective. He argues that these separate approaches have attempted to optimize either the structural or the behavioral variables. He proposes that, in reality, the structural and behavioral variables interact and that the design of management control systems requires an integration of these two variables.

C. MANAGEMENT CONTROL DEFINED

Anthony [Ref. 7: p. 17] defines management control as "... the process by which managers assure that resources are obtained and used effectively and efficiently." While this definition broadly describes the purpose of management control. Other authors define the concept in slightly different, more specific terms. The following are some of the various definitions:

> Fayol: "Control consists of verifying whether everything occurs in conformity with the plan adopted, the instructions issued, and principles established. It has for an object to point out weaknesses and errors to rectify and prevent recurrence." [Ref. 6: p. 107]
>
> Koontz and O'Donnell: "The managerial function of control is the measurement and correction of the performance of subordinates in order to make sure that enterprise objectives and plans devised to attain them are accomplished." [Ref. 5: p. 639]
>
> Anthony, Deardon, and Bedford: "All methods, procedures, and devices, including management control systems, that management uses to assure compliance with organizational policies and strategies." [Ref. 4: p. 5]
>
> NAVSO P-3013-2: "The methods and procedures which ensure the efficient and effective use of all resources (input) in relation to mission performance (output)." [Ref. 9: p. 124]

Although these definitions vary to some degree, there is a definite consensus as to the the overall nature of management control. According to Koontz and O'Donnell [Ref. 5], all control processes can be reduced to three steps: (1) establishing standards; (2) measuring performance against these standards; and (3) correcting deviations from standards and plans.

While this simplified Koontz and O'Donnell three-step notion of control is not incorrect its emphasis can be misleading. According to Mockler, the act of measuring and comparing is often the easiest step to perform, and if a manager takes action only to correct errors he will fail to realize the benefits that come from emphasizing positive (instead of negative) control action. He states, "management control is a systematic effort to set performance standards consistent with planning objectives, to design information feedback systems, to compare actual performance with these predetermined standards, to determine whether there any deviations and to measure their significance, and to take and action required to assure resources are used in the most effective and efficient way possible in achieving objectives." [Ref. 6: p. 2]

A survey of modern management control literature reveals that in addition to the measuring, comparing, and correcting orientation of the previously mentioned definitions, there are a number of management control principles which are fundamental to good management control. These principles are composed of both structural and behavioral variables and include factors such as: organization structure, measurements, control tools, information system, performance appraisal, and motivation. The greater the emphasis given to these fundamental control principles the greater the distinction between the previously discussed traditional concept of control and management control.

D. MANAGEMENT CONTROL PRINCIPLES

Burke [Ref. 10: p. 157] states that "without a set of guiding principles which can be used to evaluate a system, the data collected may remain nothing more than a mass of confusion, merely an array of comments from a variety of people." In discussing the concepts of control the point was made that management control has been traditionally viewed from either a structural or a behavioral perspective. The point was made that in reality, these variables interact, and that the consideration of these variables should be integrated into one perspective. From an integrated perspective, an overview of six management control principles which are considered necessary for a good control system are now addressed. These principles will provide a structure from which analysis of the AFM funds control system can be conducted.

1. Organization Structure

Organizational structure refers to internal patterns of influencing behavior (Thompson, 1967). As previously discussed, organization implies some ordering of work roles whereby the authority and resources for making decisions and performing tasks are distributed to defined positions within the organization.

Organizational strategy for control may be one of centralization or decentralization. Centralized control strategy concentrates decision making authority at the top levels of the organization. Maintaining control by centralized

decision making reduces the need for organization, systems, procedures, and specialist personnel to operate administrative systems. Further, it reduces perceived control by individuals at lower levels of the organization (Child, 1973).

To the extent that activities are specialized, standardized, and formalized, decision making authority and tasks can be controlled by decentralization and structuring of activities. The trend toward decentralization coincides with the rapid growth of large business. It provides a systematic means of delegating a portion of the decision making responsibility to operating personnel and motivates managers in charge of certain organizational activities by bringing them more closely in touch with an organization's objectives. In a decentralized and structured organization, legitimate activities are clearly defined, areas of responsibility and authority are clearly delineated, and control is essentially predefined performance measures. Since areas of authority are clearly defined, decision making can be delegated while organizational control is maintained. Individuals may feel that they have a great deal of control within areas of authority. A decentralized and structured organization operating in a stable environment is particularly well suited in the area of budgetary control (Burns and Waterhouse, 1975).

2. Measurements

According to Gibson, Ivancevich, and Donnelly (1979), goal refers to a future state or condition which when realized

contributes to the fulfillment of the organizations mission. Goals are statements of planned or desired results derived from the organizations mission. They normally are very broad based and not easily quantifiable. However, goals should be well defined in order to facilitate management control. Well defined goals direct performance, reduce uncertainty, and serve as an instrument of communication [Ref. 1].

The same way that goals should be derived from the organization's mission, objectives should be derived from the organizations goals (Gibson, Ivancevich, and Donnelly, 1976). Both specify ends sought, but differ with respect to the time period and degree of specificity. Objectives are specific results which are contemplated within a specific time period and should be stated in measurable terms. If an objective is not stated in quantifiable terms, performance toward meeting that objective cannot be measured.

Once objectives are quantified, performance measurements or standards can be established. Measurement standards may be for cost, level of output, or any factor that management desires to control. Mockler [Ref. 6], maintains that the establishment of standards for measurement purposes is the most critical aspect of control, and that the more realistic standards are, the more meaningful will be the conclusions drawn from comparing actual results to these standards. He also proposes that in setting standards the motivation

towards achieving those standards is enhanced by subordinate participation in their establishment. If the people who are subject to the measurement standards participate in their creation, the meaning of deviations from the standard can be uncovered more quickly and easily and the necessity of taking corrective action can be kept to a minimum.

3. Control Tools

Control tools have been defined as mechanisms used to collect and organize data, feed it back to the decision maker, and facilitate comparisons with predetermined standards. Without complete, inclusive control measures, decision quality and data utilization may not be acceptable. According to Anthony and Herzlinger [Ref. 1], control devices should be applied to some stated standards of performance and, because the quantity dimension of output is usually easier to measure than the quality dimension, care must be taken to prevent a dysfunctional emphasis on quantity.

While numerous non-budgetary control devices such as probabilistic estimates, sensitivity analysis, and cost/benefit analysis, exist budgetary control devices are the most common type. They are extensions of the accounting system designed to fulfill a specific control purpose. [Ref. 6] Because this study is directed toward the analysis of a financial control system in a nonprofit organization, the budget will be the primary control tool upon which this discussion will focus.

A budget is a statement of expected results expressed in numerical terms. It allows management to state its organizational plans quantitatively for a given time period, and to guide its actions during that period. As a quantification of a financial plan, it provides a basis for directing and evaluating the performance of an organization. It is management's blueprint for action; through it subordinate units know what to expect and the activities of an organization can be coordinated and controlled. [Ref. 6]

Argyris (1953) stated that human elements must be recognized in budgetary control; budgets are accounting techniques designed to control performance through people. In budget development, it is necessary to have a clear understanding of each managers responsibility, accountability, and authority to achieve budget objectives. An individual should not be held accountable for achieving budget objectives unless he has the operational responsibility and authority to achieve them. The operating responsibility should therefore be stated in unequivocal terms, and the authority for action should be clearly delineated. The budget should also be constructed to differentiate clearly between controllable and uncontrolable costs.

Hanson (1968) states that the budget should strike a balance between setting standards that are too easily attained and those that are too difficult to achieve. If

budget standards are not realistically attainable, inefficiency and subordinate frustration will likely result. On the other hand, budget standards which are too easily attainable are also likely to be inefficient, since they should lead to lower performance than would otherwise be possible. Both of these extremes cause the budget to lose effectiveness as a control tool. In order to obtain efficient and productive performance, budget goal must be attainable yet challenging.

Mockler [Ref. 6] indicates that one method for achieving this balance is the use of a flexible budget. Bozin [Ref. 2] states that the essential feature of the flexible budget is that it explicitly incorporates a relationship between cost and volume. Under a fixed budget, goals become meaningless as soon as the operating level varies from the one assumed. A flexible budget is intended to provide appropriate goals regardless of the operating level by fixing different budget levels for different levels of operation. Flexible budgets use the organization's historical resource requirements and past experience in preparing budgets for short term operations. Objectivity and accuracy come from careful technical examination of past operating experience and adjustments for changes in environmental conditions. When flexible budgets are properly used they can yield highly reliable results not only for management and budgeting of the organizations resources but also for performance evaluation (Houck, 1979).

4. Information System

The importance of control devices to the control process has been discussed. Yet for management control to be effective, a systematically organized and developed processing and reporting system is required. The system should facilitate comparisons of results, uncovering deviations from standards, and guide the way to corrective action.

Information forms the basis for all managerial actions and can be defined as a fact, data, observation, perception, or any other thing that adds to knowledge. It may be either systematic or non-systematic, meaning that it either flows through the formal system or external to the formal system. It can be generated internally or it can flow into the organization from its external environment, and it can be quantitative or non-quantitative. It is obtained either by direct observation or by communication. Information obtained by the manager is enriched by his own ideas and experience and leads to the formulation of policy and plans of action for their implementation. As plans become operational, information (feedback) becomes the basis for replanning and for the prevention and correction of deviations. [Ref. 4]

According to Anthony, Dearden, and Bedford [Ref. 4], management information systems should be constructed with the objective of filtering unneeded information and conveying only relevant information to the decision maker. While designers of these systems can not know exactly what information

will be relevant, they attempt to filter out irrelevant information, and to communicate critical information according to the needs of each user. Three overlapping basic concepts of information are useful in identification of the type of information that should be contained in a management control system.

1. Information is a product that <u>reduces uncertainty</u> about which action to perform, or <u>reassures</u> a decision maker about a prior action.

2. Information performs an <u>awareness function</u>. When management control systems have a responsibility to the development of organization strategy, in addition to the primary responsibility of assuring that strategies are carried out, a definition of information as a product that reveals possible opportunities for the organization is a useful guide.

3. Information serves an <u>evaluation function.</u> It is relevant to a management control system if it discloses the extent that planning actions and expected outcomes are realized.

5. <u>Performance Appraisal</u>

Performance appraisal provides information on the status of organizational activities. According to Gibson, Ivancevich, and Donnelly (1976), performance appraisal serves three purposes for management. First, it provides feedback regarding performance. Second, it is a basis for modifying or changing behavior to meet organizational objectives. Third, it is a basis to assign incentives or rewards.

Hersey and Blanchard (1977) urge that the criterion for individual or group behavior be mutually decided upon in advance. In making these decisions they state that superiors and subordinates should consider outputs and goals. This

process has two advantages. First, it permits subordinates to participate in determining the basis on which their efforts will be judged. Second, involving subordinates in the planning process will increase their commitment to the objectives established.

Performance appraisal should motivate subordinates to work for organizational goals. To achieve this desired motivation, performance appraisals must point out how near or how far away subordinates are from established standards. It should also provide information necessary for corrective action. [Ref. 6]

6. Motivation

Management control is exercised through the organization and the people working within it. Without proper consideration of human factors, cooperation which is necessary to the control process will not be present. Exercising control thus requires a consideration of behavioral variables such that motivational factors will be integrated into each of the previously addressed management control variables.

E. CHARACTERISTICS OF NON-PROFIT ORGANIZATIONS

The previously addressed principles of management control can be applied to many different kinds of functional activities, in many types of organizations, both profit-seeking enterprises and non-profit organizations. However, the focus of this study is upon the management control of a non-profit organization. Therefore, a discussion of the special control

problems within a non-profit environment (such as the Navy) is of value for the analysis of the AFII funds control system.

The preponderance of management control literature is oriented toward profit-seeking organizations. These texts make the assumption that management principles are general in nature and they are applicable, for the most part, to non-profit oriented organizations as well. Although the distinction between the two is somewhat fuzzy, there are differences that are worth noting. In a profit oriented organization decisions made by management are intended to maximize (or at least maintain) profits. Management's criteria for appraising proposed courses of action, and for measuring effectiveness, efficiency, and performance in general, is largely through the amount of profit the organization earns (MacCrimmon, 1979). By contrast, in a non-profit organization which by definition has no profit motive, managers make decisions which are intended to result in the provision of the best possible service with in available resources. Generally, the success of a non-profit organization is gauged by how well the organization meets its goals. That is, success is measured primarily by the quality and quantity of the services rendered (Gambino and Reardon, 1981).

According to Anthony, Dearden, and Bedford [Ref. 4], "service" is a more vague, and less measurable concept than "profit", and it follows that it is more difficult to measure performance in a non-profit organization. They further

state that it is more difficult to make rational decisions among alternative courses of action in such an organization because in a non-profit organization the relationship between costs and benefits, and even the amount of benefits, are difficult to measure.

A control system is concerned with the accurate measurement of both inputs (costs) and outputs (benefits) in determining efficiency and effectiveness. Since the inputs of all organizations can normally be measured if terms of monetary cost, it is the output measurement which makes the management control of the non-profit organization more difficult than that of a profit oriented business. Anthony and Herzlinger [Ref. 1] list several problems which a non-profit organization experiences due to the absence of a profit measure.

1. No clear cut single objective function that can be used in analyzing alternative courses of action exists.

2. There is no accurate way of estimating the relationships between inputs and outputs.

3. There is difficulty in measuring performance. How much service should have been rendered for the input cost is highly subjective and often impossible to estimate.

4. Delegation of decisions to lower level managers is often difficult because of this lack of a clear cut, common goal.

5. Comparison of organizational units is often impractical due to dissimilar objectives or goals.

Managers in non-profit organizations should recognize these fundamental differences, but this recognition should not lead to an attitude that management control is unimportant,

inappropriate, or hopeless. Rather, it should lead to a commitment to devise and implement the best possible control structure and control process under the circumstances (De Oliveria, 1980). Anthony and Hezlinger [Ref. 1: p. 65], state that while these problems are inherent in public organizations due to their non-profit nature "great improvements in output measurement is indeed possible, and that the problem is so important that a considerable effort to make such improvements is worthwhile...."

In the absence of quantifiable performance measures, managers in non-profit organizations must do all that they can to assure that resources are used efficiently and effectively. Management must carefully consider what the organization's goals and objectives are and develop other criteria for deciding on matters such as programs and budgets. Given the absence of profit as a performance measure, management must substitute other performance measures and ways of evaluating the organizations's success (De Oliveria, 1980). Gambino and Reardon (1981) suggest the use of surrogate measures as a means of evaluating the performance of the non-profit organization. They define a surrogate as a quantifiable, substitute measure used to assess an intangible outcome. Anthony and Herzlinger [Ref. 1] suggest that if adequate output surrogate measures of performance cannot be determined, then an input surrogate must be subsituted as a proxy. Further they state that although generally less desirable then a true output measure, input proxies are better than

no measure at all. In a non-profit organization input costs are frequently used as a surrogate input measure of performance.

F. SUMMARY

It is generally accepted that "control" is an essential ingredient for effective management. While the word "control" may connote numerous interpretations and be used in many ways, this study focuses on "management control". This chapter began with a discussion of the concept of control. It was suggested that control has been traditionally viewed from either a structural perspective or a behavioral perspective. The structural perspective relates to the evaluation of desired physical outcomes and the making of corrections when necessary. The behavioral perspective, on the other hand, involves consideration of the human relations aspect of control. It was suggested that in reality structural and behavioral variables interact, and that management control should not attempt to optimize one at the expense of the other. Instead the consideration of these variables should be integrated into one perspective which would best serve the organization. Next, from a review of the literature, a set of six management control principles were developed which are considered necessary for a good management control system. These principles form a structure to analyze the effectiveness and efficiency of the AFM funds control in meeting its objectives. Lastly, this Chapter described some of the special problems associated with the management control of non-profit organizations.

III. NAVY FUNDS FLOW

A. GENERAL

To understand the environment within which the AFM funds control system operates, an overview of the Navy flow of funds is necessary. This chapter begins with a discussion of appropriation types and the flow of funds down through the chain of command. Next, the budget development process is described. In the remaining section, the AFM concept, including a definition of AFM funds and the levels of maintenance where these monies are used, is presented.

B. APPROPRIATIONS

The purpose of the federal budget process is to allocate scarce resources among competing public demands in order to seek attainment of objectives. The federal budget cycle has three main phases: (1) executive formulation; (2) Congressional enactment; and (3) budget execution. Figure 3.1 depicts these three phases and divides the first phase, executive formulation, into planning, programming, and budgeting stages. These three stages represent the components of the Planning, Programming, and Budgeting System (PPBS) which is the budget formulation process within the Department of Defense (DOD). Each of the phases interrelates with and overlaps the others (PCC Text).

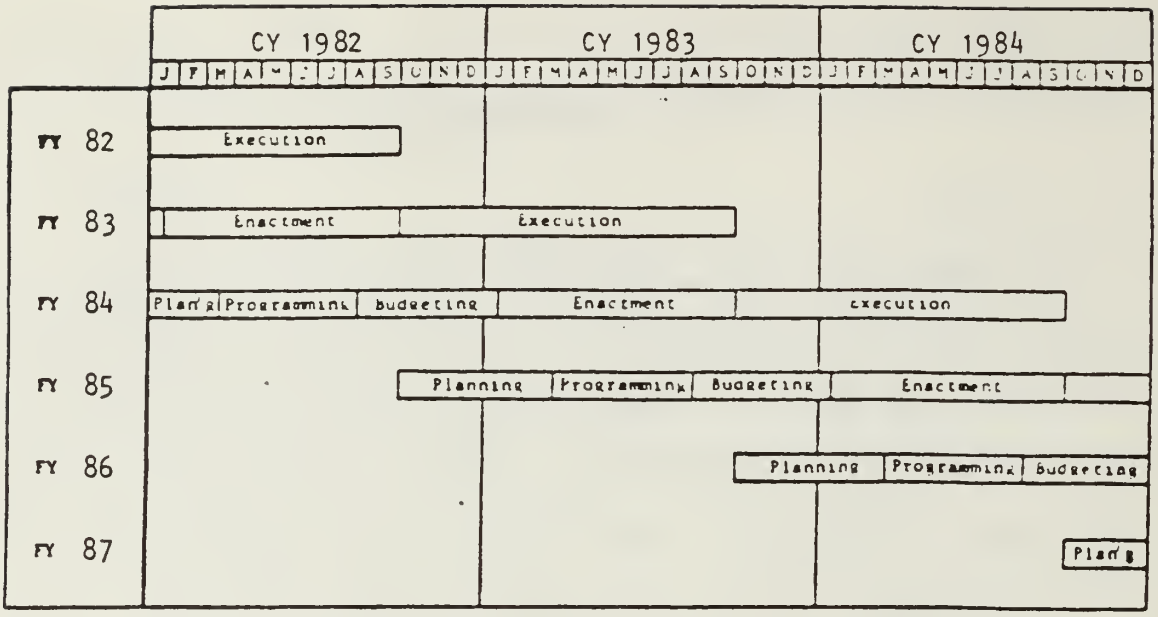

Figure 3.1 Budget Process Overview

In Chapter II the importance of the budget as a control tool for non-profit organizations, such as the U.S. Navy, was discussed. DOD budgets are formulated, justified, and executed on the basis of appropriations (NAVEDTRA 10792-D). An appropriation is an authorization by an act of Congress to incur obligations (legal reservation of funds) for specific purposes and to make expenditures (payment) out of the Treasury. An appropriation can be categorized as either an expense appropriation or an investment appropriation (FCC Text). Drawing a parallel to the private sector, an expense appropriation equates to an operational budget in a corporation, while an investment appropriation equates to a capital budget.

1. Expense Appropriations

Expense appropriations finance the cost of ongoing operations. For the Navy, expense appropriations are normally

broken down into two main sub-categories: Operations and Maintenance, Navy (O&M,N), which is used to fund all operations expenses except military personnel; and Military Personnel, Navy (MPN), used to fund military pay, allowances, and permanent change of station (PCS) travel. Within each of these subcategories separate appropriations are enacted for the Navy and Marine Corps (both active and reserve), as shown in Figure 3.2.

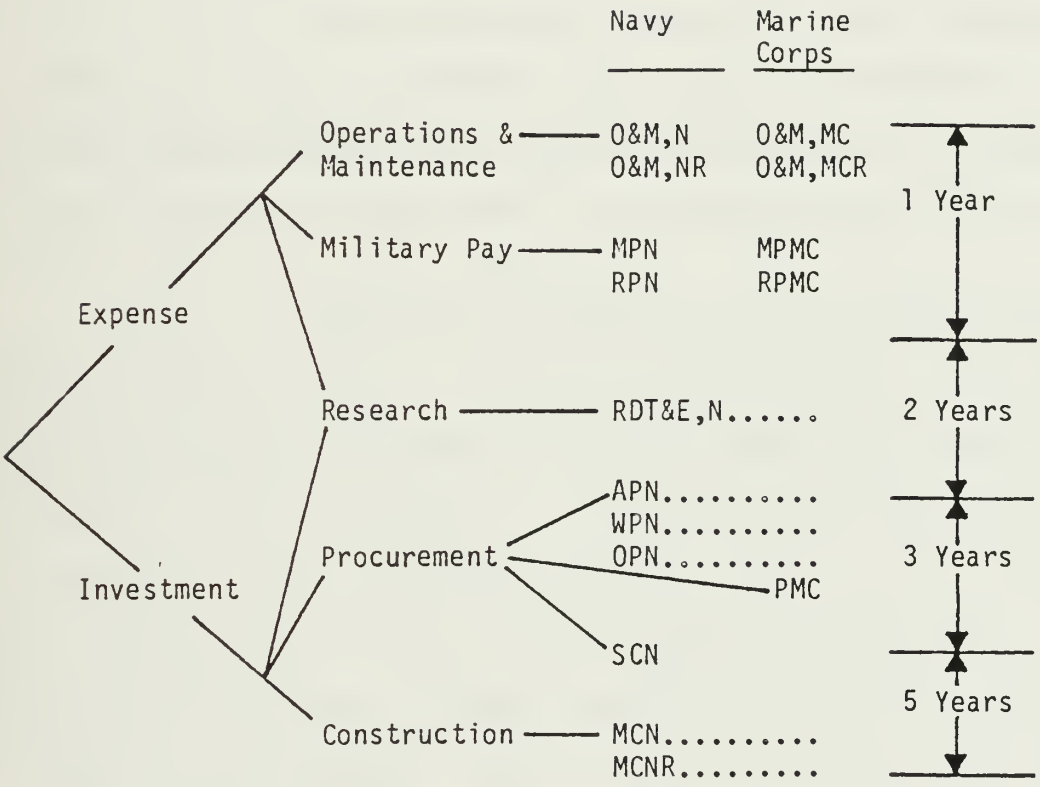

Figure 3.2 Inventory of Appropriations (PCC Text)

2. Investment Appropriations

Investment appropriations are divided into two subcategories: Procurement appropriations and Construction

appropriations. Within the procurement area, the Navy budgets and obligates for specific categories of capital investment material. These categories are: Aircraft Procurement, Navy (APN); Weapons Procurement, Navy (WPN); Ship Procurement, Navy (SCN); and Other Procurement, Navy, (OPN). The Military Construction, Navy appropriation funds the construction of new buildings, and major renovations of old structures. Figure 3.2 lists all the Department of the Navy (DON) appropriations and their respective categorization.

It should be noted that this thesis will be primarily concerned with the O&M,N sub-category of expense appropriations and the APN sub-category of investment appropriations.

C. LEGISLATION AFFECTING FINANCIAL MANAGEMENT

The U.S. Constitution Article I Section 9 states that no money shall be drawn from the Treasury but in consequence of appropriations made by law. Article II states that the President is ultimately responsible for the execution of taxing and spending legislation passed by Congress. The Anti-Deficiency Act of 1906 is characteristic of this relationship between the Executive and Legislative branches. This act holds funds managers responsible for remaining within legal spending limits and it led to Section 3679 of the Revised Statutes (31 U.S.C. 665).

The implications of this act are central for an understanding of this study. This act "prohibits any officer or government employee from making or authorizing an obligation of funds

in excess of the amount available in an appropriation or subdivision thereof or in excess of the the amount permitted by agency regulations." Further, it provides that the person who caused the violation may be subject to suspension without pay, removal from office, fines or imprisonment (PCC Text).

A second legal limitation which is pertinent to this study is Section 3678 of the Revised Statutes (31 U.S.C. 665). This law requires that appropriated funds be used only for programs and purposes for which they were appropriated. The law states, "Except as otherwise prohibited by law, sums appropriated for various branches of expenditure in the public service shall be applied solely to the objects for which they are respectively made, and for no others."

These acts have far reaching effects on financial management since they prohibit the over-expenditure of appropriated funds and the expenditure of funds for uses other than originally intended by Congress. Thus if the Navy wishes to increase the amount of resources devoted to a project or area of appropriation, it must initiate reprogramming action which moves resources between programs within an appropriation or a transfer action moves resources between appropriations (PCC Text). Legal limitations exist which limit the extent of reprogramming which may occur within an appropriation before Congressional involvement is required. All transfer actions require Congressional approval.

D. FUNDS FLOW

While the culmination of the Congressional enactment phase results in appropriations of various types, the next step in the budget process is the distribution of funds and initiation of the execution phase, (see Figure 3.1). One of the initial steps in this phase is implementation of the Appropriation Act enacted by Congress (in phase two of the budget cycle) and signed by the President. The Appropriations Act sets out specific amounts and purposes for each appropriation. The act is implemented through the issuance of an appropriation warrant by the Treasury Department. The director of the President's Office of Management and Budget (OMB) then apportions, on a quarterly basis, the annual amounts appropriated for each agency. The Department of the Navy's (DON) apportionment is passed to the appropriation sponsor within the office of the Chief of Naval Operations (CNO).

All Navy funds except Research, Development, Test and Evaluation, Navy (RDT&E,N) and Marine Corps funds, flow through the office of the CNO (OP-92). Thus the CNO's comptroller is the responsible office for these appropriations for both SECNAV and CNO. As such, OP-92 has overall responsibility for budgeting and reporting for all programs financed by an appropriation for the fiscal year (PCC Text).

The CNO (OP-92) reallocates the Procurement and the Military Construction appropriations (investment funds)

to the Chief of Naval Material (CNM) for further reallocation to subordinate system commanders. The CNM is charged with bringing requirements into being, through the acquisition process, and providing a logistics system of maintenance and supply support for their operations. The CNM operates through five systems commands: Naval Air Systems Command (NAVAIR), Naval Electronics Command (NAVELEX), Naval Sea Systems Command (NAVSEA), Naval Facilities Command (NAVFAC), and Naval Supply Systems Command (NAVSUP). Three of these, NAVAIR, NAVSEA, and NAVELEX (termed Hardware Systems Commands) are charged with overall responsibility for acquisition and maintenance of the weapons systems. NAVFAC provides a similar function for facilities requirements of ashore naval forces, and NAVSUP is responsible for the structure and operation of the supply system in support of the operating forces and shore establishment (McComb, 1982). In the case of APN funds, the Naval Air System Command (NAVAIR), contracts for provisioning requirements of end items such as aircraft and aircraft engines, and assigns program responsibility to the Inventory Control Point (ICP) (i.e., the Aviation Supply Office (ASO)). Once the ICP is assigned program responsibility, NAVSUP establishes the logistics policy to be followed.

The O&M,N funds (expense type) are reallocated by OP-92 to subordinate commanders called major claimants. While there are a total of thirteen major claimants, each with

specific areas of responsibility, for the purposes of this study the major claimants (those which deal with AFM funds) refer to the Atlantic and Pacific Fleet Commanders in Chief. The major claimants then issue expense operating budgets (EOBs) on a quarterly basis to the sub-claimant or Type Commander level. The Type Commanders are that organizational level responsible for managing and directing operational and staff support units. They provide policy, direction, and guidance in such areas as supply, logistics, and financial management. The two aviation Type Commanders are: Commander, Naval Air Force, U.S. Atlantic Fleet (COMNAVAIRLANT); and Commander, Naval Air Force, U.S. Pacific Fleet (COMNAVAIRPAC). The Type Commanders issue funds in the form of expense operating budgets (EOBs) to their NASs. Naval Air Stations in turn allocate funds to individual squadrons under their command in the form of an OPTAR for aircraft maintenance requirements. An OPTAR is an administrative ceiling on funds which limits the amount of funds that can be spent by a activity. The Type Commanders also issue funds to aircraft carriers in the form of OPTARs (Reily and Sheppard, 1980). This flow of O&M,N funds is shown in Figure 3.3.

OPTARs which are held by the operating units are not subject to the spending regulations and limitations set by Congress which pertain to regular allotments under the provisions of Title 31, U.S. Code 665 (R.S. 3679). The limitations imposed by R.S. 3679 apply throughout the chain

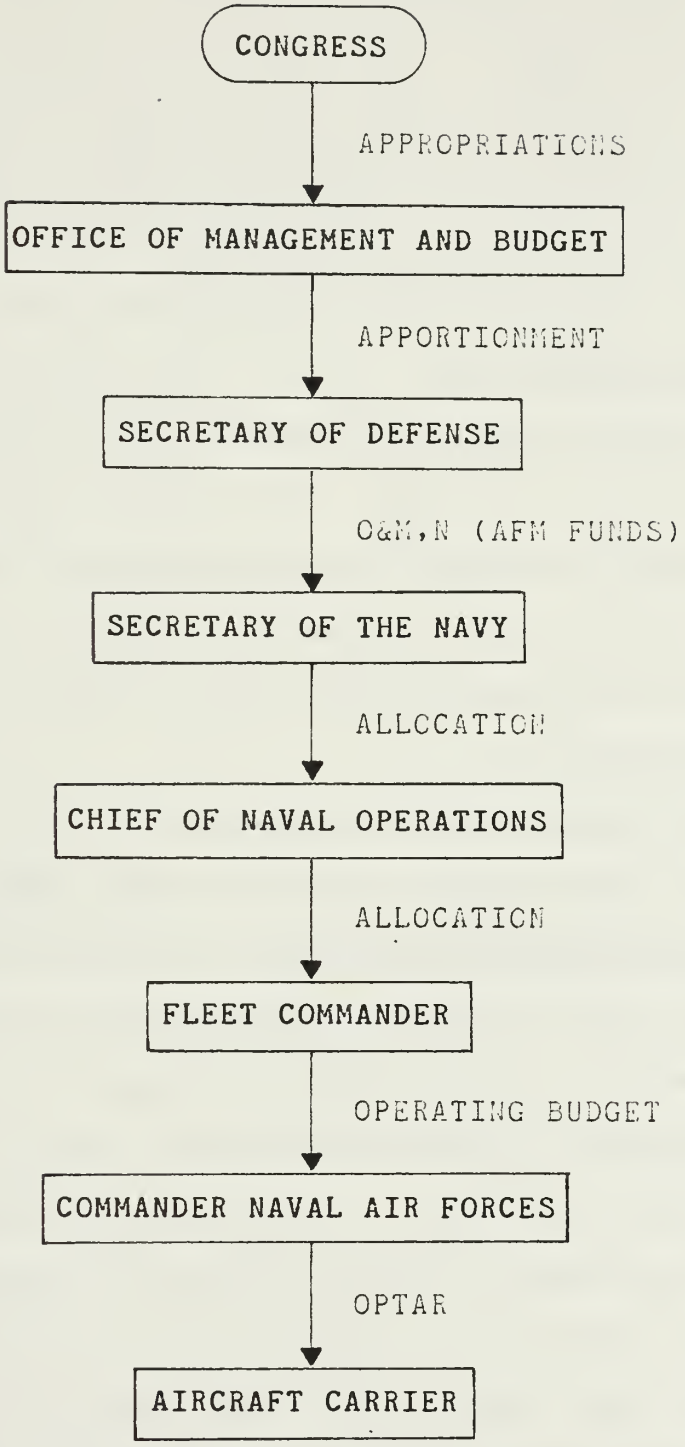

Figure 3.3 O&M,N Appropriations Funds Flow (PCC Text)

of command, from the fleet commander down to the operating budget holder but does not apply to funds passed in the form of an OPTAR. Consequently the Commanding Officer of each aircraft squadron is held only administratively responsible to the Type Commander for insuring that the unit does not overspend its OPTAR grant authority.

E. BUDGET DEVELOPMENT

The O&M,N budget requirement is developed in the spring (May/June) of each year. It formally begins with the Navy Comptroller (NAVCOMPT) (OP-92) issuing a budget call which requests that Type Commanders submit budget requirements which are necessary to fund operational requirements and staff functions.

Budget requirements are requested for the current (execution) year, the apportionment year, and the budget year. Current year and apportionment year data are used to refine apportionment requests and allotments to agencies and commands, once the money has been appropriated by Congress. Budget year data is included in the Navy O&M portion of the DOD budget that will constitute, in part, the President's budget (PCC Text).

In anticipation of the NAVCOMPT (OP-92) budget call, the Fleet Commanders issue requests for O&M,N cost data from the Type Commanders in the February/March timeframe.

The COMNAVAIRLANT and COMNAVAIRPAC air operations portion of the budget input consists of costs per flight hour, developed for each type-model-series (TMS) aircraft in their inventory.

This baseline cost-per-hour is an estimate of the maintenance dollar costs and fuel expenditures in relation to the number of flight hours flown for each specific aircraft model and type. It should be noted that the budget formulation process makes the assumption that there is a direct and positive correlation between maintenance costs and flight hours.

The O&M,N funds passed to the Type Commander's contains funds to support two distinct purposes; flight operations (primarily aviation fuel) and aviation fleet maintenance (AFM). Of these two components AFM is of primary concern to this thesis. AFM funds are end-use monies (funds expended by operational units) which are used to buy material and supplies which are consumed in the performance of organizational and intermediate levels of aviation maintenance (COMNAVAIRLANTINST 7310.5H, 1983).

The United States Navy's Financial Management of Resources (operating forces) NAVSO P-3013-2, defines several categories of material and or services which may be financed with AFM funds [Ref. 9]. For illustrative purposes, a partial listing of those categories of materials and supplies for which AFM funds expenditure (actual payment of funds) is authorized is provided.

	Material or Services	Use
1.	Paints and cleaning supplies	Aircraft preventive maintenance and corrosion control
2.	Consumable repair parts, field level repairables, and stock funded DLRs	Repair related aircraft materials
3.	Aviation fuels and lubricants	Aircraft engine testing
4.	Tools and special clothing	Job performance and safety
5.	Allowance list	Replacement of special tools and ground support equipment allowances

Organizational level maintenance is that maintenance performed by the individual squadron on its aircraft and is limited to troubleshooting and minor repairs of a routine nature. Intermediate level maintenance is that maintenance performed by an aircraft carrier (CV), Marine Aircraft Group (MAG), or Naval Air Station Intermediate Maintenance Department (AIMD). Intermediate level maintenance is more complex in nature and includes major servicing, major equipment repair, and detailed inspections. In contrast, depot level maintenance is performed at specialized repair facilities such as a Naval Air Rework Facility (NARF) or a civilian manufacturer's plant. The type of work accomplished includes, major overhauls and airframe modifications. AFM funds are not used in support of depot level maintenance and it is not addressed in this thesis.

The data base used for the preparation of the AFM budget request consists of the Monthly AFM Budget Financial Reports and Flying Hour Cost Reports. These financial reports provice AFM cost information charged to specific maintenance actions by model and type. The Flying Hour Cost Reports indicate the number of flight hours recorded for specific aircraft models and type. The maintenance cost data are totaled for each aircraft model and type from all sources and divided by the total number of flight hours of each aircraft model and type to compute a weighted AFM cost per hour.

The cost-per-flight-hour information is forwarded by the Type Commanders to the Fleet Commanders who pass it on to NAVCOMPT (CP-92). This data is used in conjunction with projected flight hours provided by the resource sponsor for Naval Aviation, the Deputy CNO for Air Warfare (CP-51C), to determine the AFM budget figure. NAVCOMPT (CP-92) consolidates the AFM budget element into the total operation and maintenance, Navy (O&M,N) appropriation request. It is then forwarded to the office of the Secretary of Defense (OSD) for review and inclusion in the Department of Defense (DOD) budget submission to the Office of Management and Budget (OMB) (Reily and Sheppard, 1980).

F. SUMMARY

The preceding chapter was primarily concerned with the flow of Navy funds. Appropriations were identified as the source of Navy funds and that there are two types of Navy

appropriations: expense and investment. Within these two types, the O&M,N sub-category of expense appropriations and the APN sub-category of investment type appropriations are germane to this study. The O&M,N sub-category can be further sub-divided into flight operations funds and AFM funds. AFM funds can be defined as those funds which are expended in the performance of organizational and intermediate level aircraft maintenance. Of particular importance to this study's analysis of the AFM funds control system is the recognition that AFM budgets are used primarily as ceiling limits which carry R.S. 3679 legal responsibility down to the operating budget level but not OPTAR level and that AFM funds can not be expended for APN material.

IV. STOCK FUNDING OF AVIATION DEPOT LEVEL REPAIRABLES

A. GENERAL

This Chapter begins with a background discussion of the nature of the Navy Stock Fund. It then describes the categories of material which is contained in the supply system. The next two sections discuss the current and planned methods of procuring and repairing AV-DLRs and provides a discussion of the factors which contributed to the CNO's decision to convert the stock funding of AV-DLRs. The remaining section provides an assessment of the impact the stock funding of AV-DLRs will have upon AFM funds management.

B. NAVY STOCK FUND

The Navy Stock Fund operates under a management concept which has evolved over a period of 100 years and is the oldest stock fund in the DOD. The Navy Stock Fund Act of 1893 established the basic concept of the NSF as it exists today. That is, a a "corpus" or body of capital which is reimbursed by the customer's OPTAR when material is issued (PCC Text). In 1949, with the ammendment to the National Security Act of 1947, Congress approved stock funds for the other military services. Among the features of the National Security Act was authorization (10 U.S.C. 2208) for the Secretary of Defense to establish working capital funds for the purpose of financing supply inventories and

the capitalization of industrial type activities (Earl, 1965). The NSF is operated in accordance with the Department of Defense Directive 7420.1, "Regulations Governing Stock Fund Operations" (PCC Text).

The NSF is a working capital fund which is used to purchase and hold inventories of supply items. The charge for an item is held in suspense until the end-user requisitions the item citing appropriated funds. That is, when items are issued from the NSF to user activities, the users financing appropriation reimburses the stock fund for the items drawn, thus providing resources which can be to purchase new items to replace inventory (Inventory Management). Because of this feature the NSF is categorized as a revolving fund. The two major assets on the NSF balance sheet are material inventory, carried in the Navy Stock Account (NSA), and cash. The goal of the NSF is to recover all costs of operation and work to a zero profit. Figure 4.1 provides an illustration of the above described nature of the NSF.

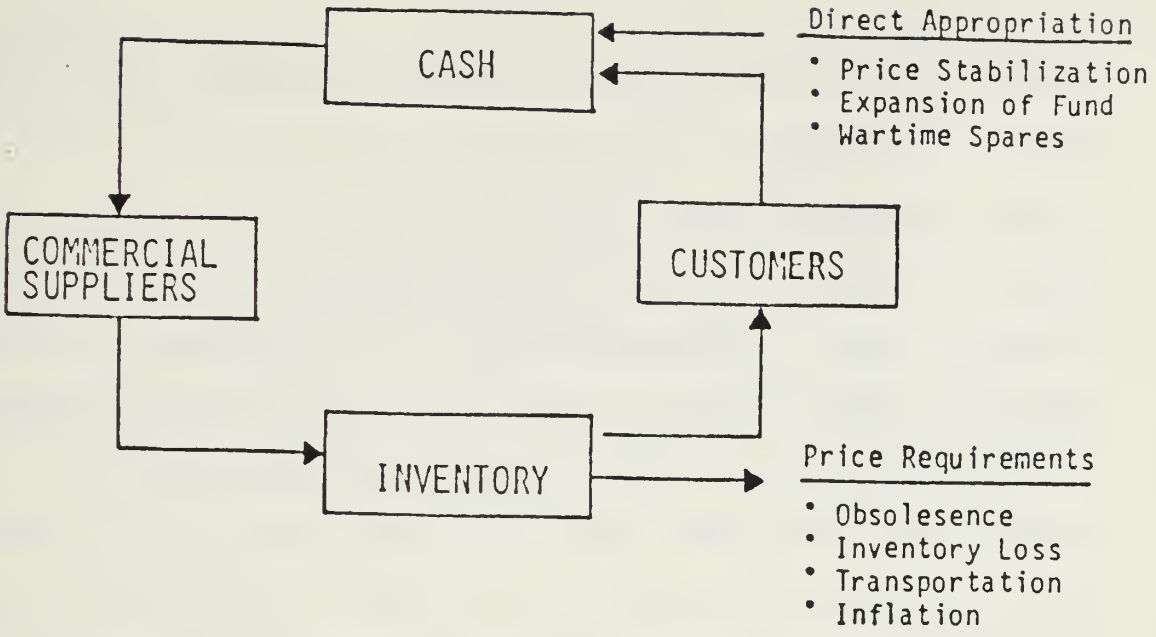

Figure 4.1 NSF Relationships (PCC Text)

C. MATERIAL CATEGORIES

Material carried in the supply system can be divided into two major categories; principal and secondary end items.

1. Principal Items

Principal items generally stand alone and perform a function. They are end items such as aircraft and aircraft engines, radar systems, and computer systems. These items are normally staged in the logistics or supply system until released for use, as opposed to being stocked in the supply system in anticipation of customer demand. Principal items are normally procured through the investment appropriations such as aircraft procurement, Navy (APN), other procurement, Navy (OPN), weapons procurement, Navy (WPN), or procurement Marine Corps (PMC). Principal items are neither purchased

by nor owned by the NSF but rather held, for inventory visibility purposes, in the appropriation purchases account (APA) within the supply system.

2. Secondary Items

Secondary items are spare parts and consumable supplies which are used in the support of principal items. Secondary items are characterized on the basis of their repairability. If an item is designated by the Navy as typically not being economically repairable, then it is considered to be consumable and is disposed of after one failure. Navy supply system stocks of these consumable expense type items are financed by the NSF and are ultimately charged to the O&M,N appropriation or other customer appropriations when issued (Giordano, 1976).

Repairable items are generally categorized for field or depot level maintenance activity rework upon failure. If an item has been categorized as a field level repairable then its procurement into the system is generally financed by the NSF. If an item is designated for repair, or condemnation, at the depot level it is called a depot level repairable (DLR) (PCC text). The depot level of repair is the highest level of maintenance, based upon the capability and the responsibility to effect complete repair, rework, or renovation, of a repairable item. It can be accomplished by either a DON, or a commercial facility (McComb, 1982). Figure 4.2 depicts the supply system material categories and its funding responsibilities.

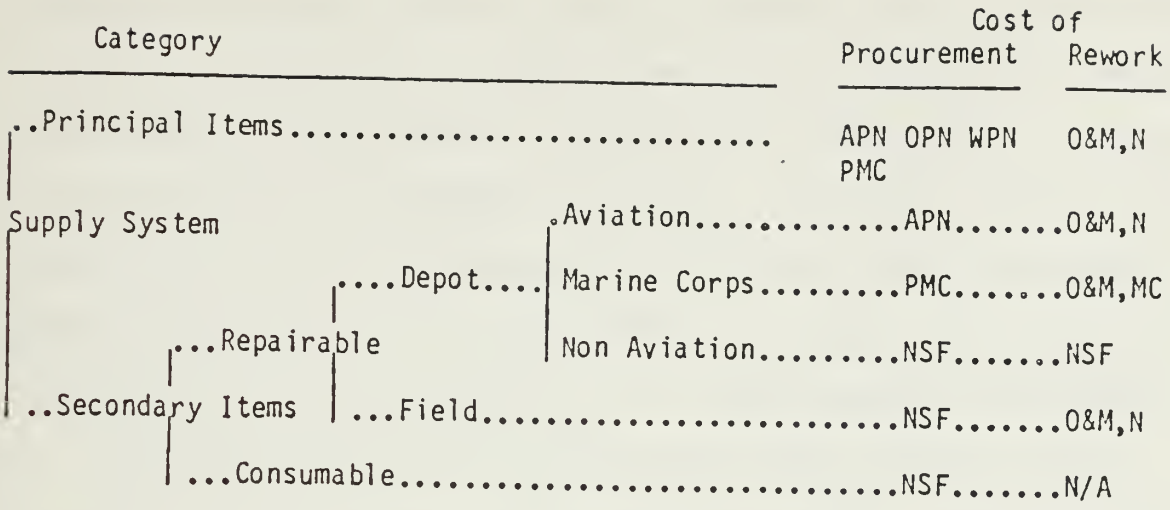

Figure 4.2 Material Categories in the Supply System

(PCC Text)

Prior to April 1981, all DLRs were issued from the NSF to users without charge and the cost of the repair was financed by the Hardware Systems Commands centrally managed O&M,N appropriations, currently all non-aviation secondary items including non-aviation DLRs are financed by the NSF. If aviation related, these items continue to be financed by procurement appropriations.

D. PROCUREMENT APPROPRIATION FUNDING OF AV-DLRs

Funding for the procurement of aviation depot level repairables (AV-DLRs) held in the supply system is currently through the Aircraft Procurement, Navy (APN) appropriations and is managed by the Aviation Supply Office (ASO). The APN procurement appropriation is used to accomplish three things: (1) finance weapon system or end item procurement;

(2) to provide interim spares support for all necessary items; and (3) to provide initial and replacement spares support, consisting of AV-DLRs in support of these equipments for their life cycle. This appropriation is available for obligation over a three year period, and has the common characteristic that it finances the procurement of investment type items (McComb, 1982).

All AV-DLRs not required for initial outfitting are held in stock at various Navy stock points, and are managed by the Aviation Supply Office (ASO), the inventory control point (ICP). Since these items are financed by Procurement Appropriations, but not yet issued to their ultimate user activities, the value of this inventory is accounted for in a stores account called the Appropriations Purchases Account (APA) (McComb, 1982).

E. O&M,N APPROPRIATION REPAIR FUNDING FOR AV-DLRs

The funding for the cost of depot level repair of AV-DLRs is provided by the Operations and Maintenance, Navy (O&M,N) expense appropriation. These funds are allocated by the Chief of Naval Operations to the Chief of Naval Material (CNM) who provides a suballocation to the Naval Air Systems Command (NAVAIR). This Hardware Systems Command is responsible for budgeting and control of the funds allocated (McComb, 1982).

When an end-user needs to have an AV-DLR replaced, the customer returns the inoperable component to an authorized depot for repair, and draws a ready-for-issue (RFI) component

from the supply system. Since the item is initially purchased through procurement appropriations (APN) and since the cost of repair is centrally funded by the responsible Hardware System Command (NAVAIR) with O&M,N appropriations, there is no cost to the customer. From the customers point of view the item is a "free issue". Figure 4.3 pictorially summarizes the process described in the preceding two sections.

As the figure indicates, procurement money (APN) is appropriated by Congress, passed through the Naval Air Systems Command (NAVAIR) and utilized by the Aviation Supply Office (ASO) to buy aviation repairables. Repair money (O&M,N) is also appropriated by congress and utilized by the ASO to fund depot level repair of aviation components. The two processes result in new or repaired aviation components being placed on shelves in a "ready-for-issue" status. When requisitioned, these items are provided to fleet units on a "free issue" basis, and the fleet and their immediate chain of command are not involved in the funding process.

F. STOCK FUND FINANCING OF AV-DLRs

In order to understand the stock funding of aviation depot level repairables and its impact upon the AFM funds control system, it is necessary to have a general understanding of the underling motivation for including AV-DLRs into this fund.

On 3 May 1978, the Vice Chief of Naval Operations directed that a study be conducted to evaluate alternative funding mechanisms for secondary item Depot Level Repairables (DLRs)

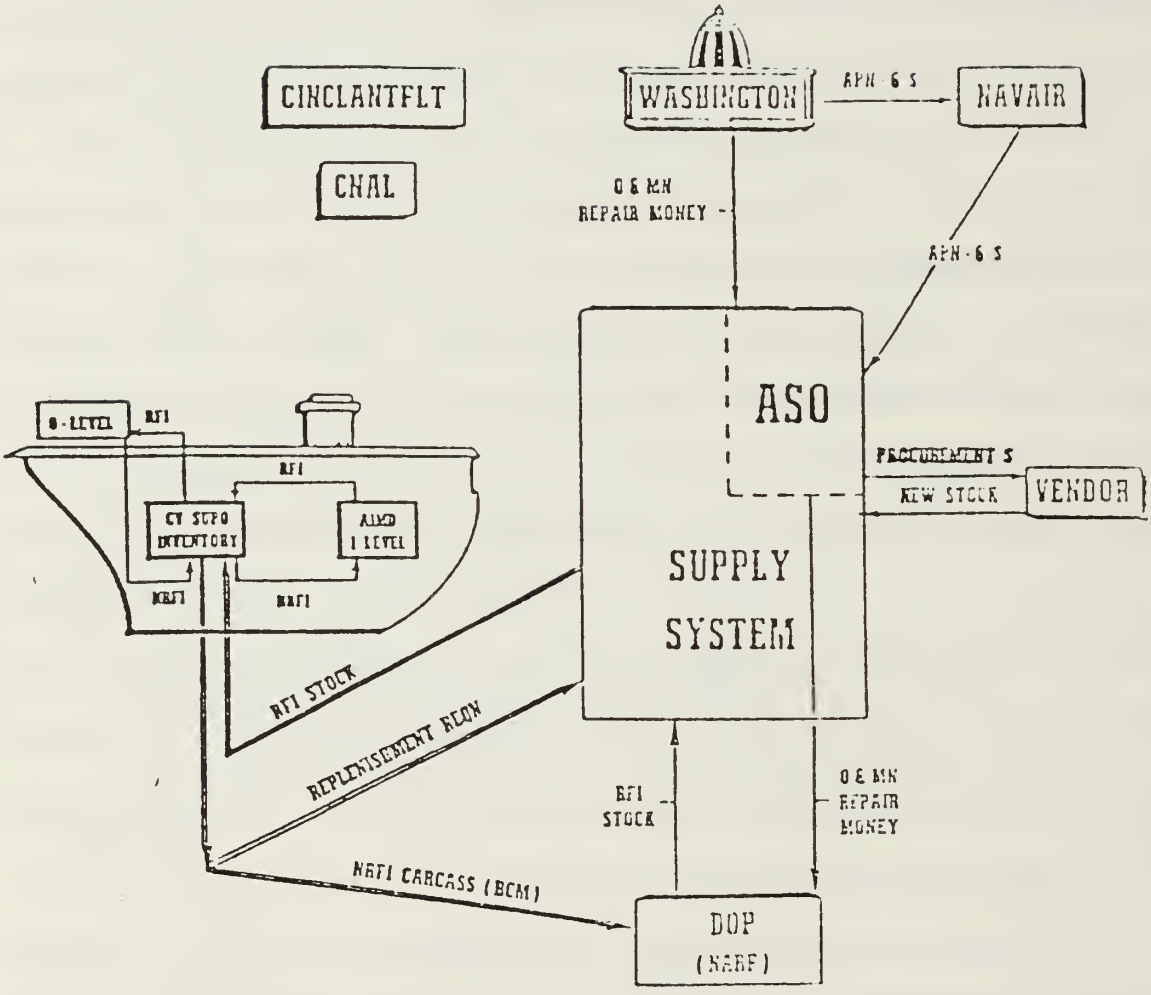

Figure 4.3 Existing Method of AV-DLR Repair/Financing

and to develop a formal Navy position on stock funding DLRs in response to official Office of the Secretary of Defense (OSD) and General Accounting Office (CAC) inquires.

The study concluded that the stock fund was preferred over the present funding mechanism for financing procurement and depot level repair of the Ships Parts Control Center (SPCC) managed non-aviation DLRs. In view of the complexity of converting DLR management from appropriation to stock fund accounting, the study recommended that a prototype program for those secondary-item DLRs managed by SPCC be implemented to provide a controlled environment to quantify the financial workload and refine procedures. On 16 May 1979, the Chief of Naval Operations (CNO) directed that this prototype program be initiated to test the stock funding of DLRs. Capitalization of SPCC managed non-aviation DLRs into the Navy Stock Fund (NSF) occured on 1 April 1981. At OSD direction, the test period was set at two and one half years. Based upon encouraging preliminary results, the CNO on 30 September 1982, directed the commencement of actions that would convert AV-DLRs to the Navy Stock Fund on 1 April 1985 (Draft Imp.).

Under NSF financing, the flow of money for depot repair or replenishment parallels the movement of the off-ship/station requisition. As Figure 4.4 indicates, ASO still receives some APN funds, appropriated by Congress to finance the procurement of new inventories, i.e., initial support for new aircraft or systems. However, once purchased, new

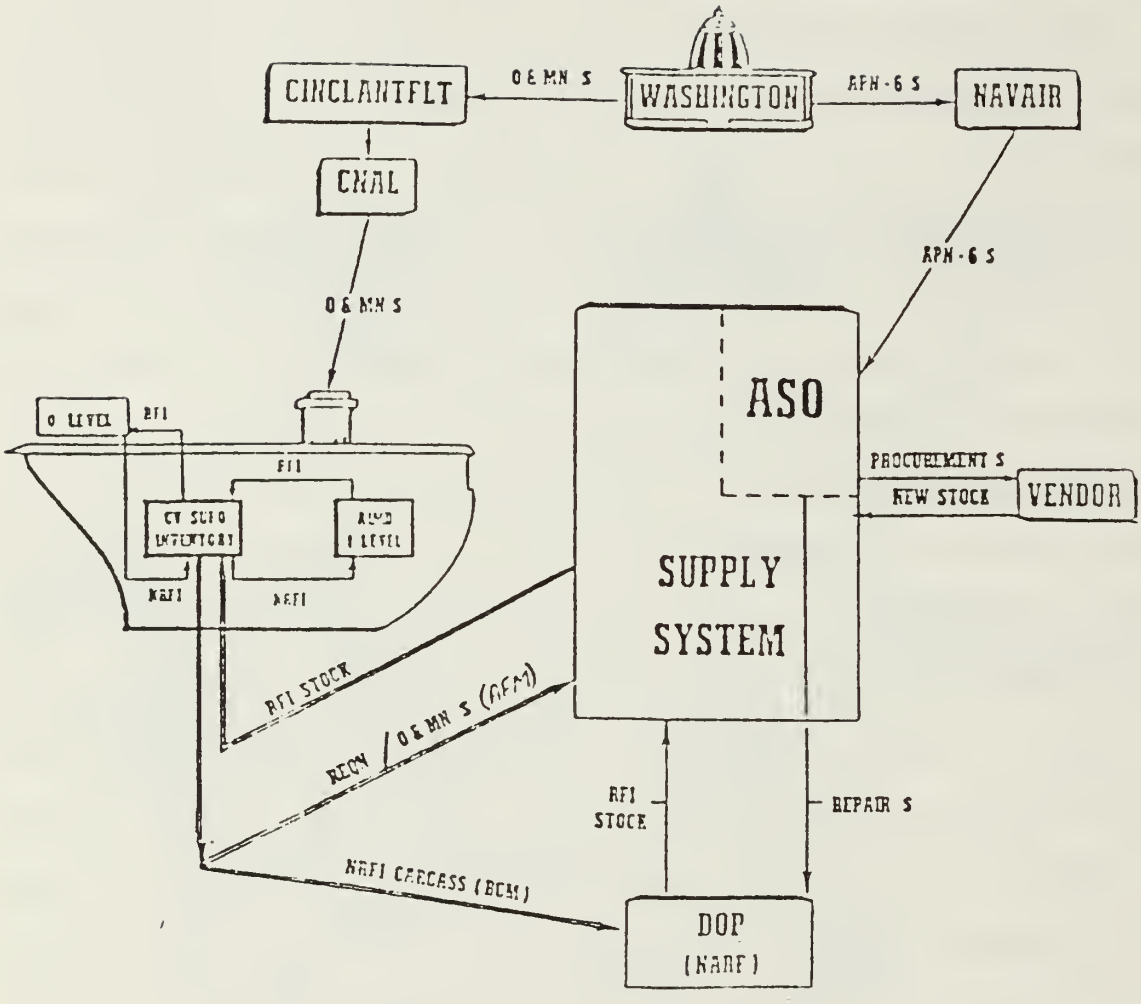

Figure 4.4 AV-DLR Repair/Financing in the NSF

inventories are absorbed into the stock fund. For normal usage, fleet units "buy" required repairables with requisitions funded with O&M,N (AFM) money. That money is in turn, used by the NSF to pay for repair or replacement of the item issued. It should be noted that as long as the AV-DLR remains in the ship/station internal repair cycle, there is no financial transaction. Funds are expended only when a "beyond the capability of maintenance" (BCM) action occurs and an external requisition is submitted.

The following benefits have been realized in converting non-aviation DLRs to NSF financing and are also expected to be realized from the AV-DLR addition to the NSF program.

a. Procurement/Repair Funding Flexibility

In the current funding environment, procurement and repair dollars are appropriated as separate amounts. As a result, repair and procurement funds can not be interchanged without a difficult and time consuming reprogramming action that requires congressional approval. Under stock funding there is a single source of funds that can be used for repair or procurement as conditions dictate. This flexibility provides the stock fund manager with an improved ability to adjust to unexpected conditions that may require more or less procurement or more or less repair than had been programmed.

b. Increased Cost Awareness

Stock funding results in a buyer-seller relationship with regards to the processing of repairables. This relationship

is expected to result in improved efficiencies and a lower overall cost of operation. An improved rate of carcass return to the designated overall point (DOP), higher intermediate level productivity, reduced "discretionary BCMs" (management decision to not attempt AIMD repair but to refer repair of a NRFI component to the DOP), improved inventory control, and better fleet reporting of unsatisfactory component failure rates are all "cost awareness" actions that are expected to contribute to improved efficiency and an overall lower cost of naval aviation.

c. Improved Support Performance

The expected net result of the AV-DLR stock funding initiative is an improved logistics support posture with a corresponding improvement in aircraft readiness.

G. AFM IMPACT

As previously stated, the implementation date for stock funding of ASO managed secondary item DLRs has been established as 1 April 1985. The financing of the procurement and repair of these aviation DLRs by the NSF will cause numerous changes in funding responsibilities within the Navy.

As with non-aviation DLRs, the transfer will result in total stock fund financing of the procurement, repair, and transportation of these items rather than the separate financing of procurement through the APN appropriation and repair through the O&M,N appropriation. AV-DLRs when requisitioned through the supply system, as with non-aviation DLRs, will require obligation of customer end-use funds.

Unlike consumables, AV-DLRs will utilize the same "two-price" system now used with non-aviation DLRs. In order to recoup costs, the NSF will bill the operational unit for AV-DLR requisitions at either a net or a standard price depending on whether a retrograde component was returned to the supply system. The point of DLR sale (i.e., where an appropriation is charged), will occur at the time a repairable is determined to be beyond the capability of maintenance (BCM) at the intermediate maintenance level. The amount of AFM funds which will be obligated by the end-user and ultimately billed by the wholesale level will be determined as follows: (1) Standard price (no carcass turn-in) = (procurement price + NSF Surcharge + DOD Price Stabilization Factor); (2) Net price (carcass turn-in made) = (repair price + depot washout + DOD Price Stabilization Factor).

One of the previously stated advantages of stock funding DLRs is the economic incentive attached to the return of not-ready-for-issue (NRFI) components to the supply system. This incentive is generated through the procedure of charging the customer a reduced or net price, rather than a standard price (an approximate 60% savings), when a NRFI DLR is turned in (Draft Imp.).

As described in Chapter III, the aviation Type Commanders receive annual O&M,N funds via the chain of command, to support aviation fleet maintenance (AFM). Such funds are provided via the flying hour projection system (OP-20 report). The OP-20 report identifies, by aircraft type-model-series

(TMS), projected AFM costs-per-hour. The number of aircraft in each TMS and projected flight hours are also indicated yielding the total funds necessary to support flight operations. OP-20 cost-per-hour factors are updated annually based on reported historical cost information forming the basis for the next years funding. Prior to the accumulation of historical cost information associated with the migration of AV-DLRs to the NSF, little data upon which to base an adequate budget estimate will be available. However, beginning in FY 1986, AV-DLR funding requirements will comprise a substantial component (approximately 70%) of the OP-20 O&M,N funding. As is the current practice, AFM funds (including the AV-DLR component) will be distributed to the ships and Naval Air Stations to support local operations (Braman, 1984).

H. SUMMARY

The primary purpose of the preceding discussion was to provide a description of how AFM funds expenditures will be impacted by the stock funding of AV-DLRs. The key issues in this chapter were:

1. The NSF is a working capital fund used to purchase and hold inventories of supply items.

2. The material in the supply system can be divided into two major categories; principle and secondary items. Principle items are end items purchased through investment appropriations such as APN. Secondary items are categorized by their repairability (i.e., consumable and repairable), and are used in support of principle items.

3. Procurement and repair of AV-DLRs is currently accomplished through APN appropriations and O&M,N funds respectively.

4. NSF financing of AV-DLRs will commence 1 April 1985. This system is expected to have two major advantages over the current system: (1) procurement and repair flexibility; and (2) increased cost effectiveness resulting from its inherent buy-seller relationship.

5. End-use AFM monies (a component of O&M,N) will procure and repair AV-DLR components. The price charged by the NSF will depend upon whether a NRFI component has been turned in to the supply system. This action will have the effect of increasing the variable component of AFM costs.

V. SYSTEM COMPARISON AND EVALUATION

A. GENERAL

Chapter II developed a set of generally accepted principles considered fundamental for effective management control. These principles can now be used to assess the impact of stock funding AV-DLRs by evaluating the existing AFM funds control system and its operating environment. This chapter compares these management control principles to data collected from AFM funds administrators regarding the status of the current control system. A summary of the nature of each principle is provided, followed by an analysis of the systems strengths and weaknesses in relation to each principle.

Data presented in this section was collected via personal interviews and telephone conversations with AFM funds administrators, primarily from personnel attached to the staffs of COMNAVAIRLANT and COMNAVAIRPAC. Additionally, a substantial source of findings was a survey of existing documentation and correspondence pertaining to the management of AFM funds. While information was obtained from various members of the Type Commander staffs, the predominant input was from the comptroller sections, and in the case of COMNAVAIRLANT, from the Readiness section.

B. CONTROL SYSTEM ANALYSIS

A comparison of the AFM funds control system to the fundamental management control principles detailed in Chapter II makes it possible to identify several notable strengths and weaknesses. The current AFM funds management system has evolved over time, however this process has introduced several problems into the system. Although each problem is treated as it arises, the current AFM system contains significant control weaknesses.

1. Organization Structure

Organizational structure refers to internal patterns of influencing behavior. The structure of a management control system requires an ordering of work roles whereby the authority and resources for making decisions and performing tasks are distributed to defined positions in the organization.

a. Strength

The organization structure within which the AFM funds control system operates is a strength. It is a decentralized system with systematic means for delegating a portion of the Type Commander decision making authority to operating units. AFM funds managers have complete decision making authority for the expenditure of AFM funds within predetermined guidelines. In these guidelines (i.e., OPNAVINST 7310.1D, Type Commander AFM instructions, NAVSO P-3006-1) legitimate activities are clearly defined and areas of responsibilities are clearly delineated. The concept of fiduciary

accountability for CPTAR expenditures is well understood by Type Commander personnel and subordinate units, and expenditures are closely monitored.

b. Weakness

While legitimate activities are clearly defined, areas of responsibility clearly delineated, and the control system well understood, management control of AFM expenditures is complicated by the absence of predefined performance measures which are necessary in a decentralized structure.

2. Measurements

As discussed in Chapter II, profit oriented organizations have an excellent measure of performance in the form of revenue or net income figures. However, good quantitative measures of output seldom exist in non-profit organizations. Additionally, one of the fundamental tenets of management control is the requirement for the establishment of performance standards and a comparision of actual performance to these standards. Organizational goals should determine the objectives that are desired and objectives in turn dictate performance standards. If organizational objectives are not established or are unclear there may not be unity of effort within the organization.

a. Strength

The AFM funds control system is an established financial control system based upon the concept of fiduciary accountability and is well documented. The accounting and

budgetary systems based on this financial structure do serve as measuring devices for this purpose. The control system possess three separate performance measures: (1) budgeted dollars, (2) budgeted flight hours, and (3) cost-per-hour. Of the three, both dollars and flight hours are estimated on a quarterly basis as planning figures. Cost-per-hour is estimated on a quarterly basis by the CNO staff and promulgated to the Type Commanders by the CNO OP-20 report. All three measures are compared at the Type Commander level against actual obligations, hours flown, and cost-per-hour as reported by the operating units. There is a workable system in place for AFM funds management.

b. Weaknesses

Both Type Commanders considered "readiness", (i.e., an indication of the material and mechanical capability of a specific aircraft to conduct its assigned operational mission), as the output generated from the AFM resource, yet neither had any formal means to correlate that output to dollar input. Nor did either have any formal means to measure the efficiency or effectiveness of the maintenance function as related to AFM usage. Several measures of unit and aircraft readiness exist, and detailed procedures are in effect that require readiness reporting to the Type Commander on a daily basis. However, it is the opinion of Type Commander personnel that because aircraft readiness is a function of numerous variables, that a simple comparison of readiness

figures with AFM usage rates would not provide a reliable measure of efficiency or effectiveness (Braman, 1984 and Dillenburg, 1984).

Definitive standards for AFM performance measurement are missing. Neither Type Commander has established specific AFM performance standards per se. This lack of performance standards represents a serious weakness in the control system. Without these predetermined measurements, comparision of actual performance with standard performance can not be accomplished, and subsequent corrective action is impossible. The absence of explicit goals and objectives can create inconsistency, lack of coordination and inefficiency.

3. Control Tools

Control tools have been defined as mechanisms used to collect and organize data, feed it back to the decision maker, and facilitate comparisons with predetermined standards. For the purposes of this study, the AFM budget and its related processes have been identified as the key control tools for management of AFM funds. These include budget development, budget allocation, and cost collection.

a. Strength

The centralized budget development process used in conjunction with a standardized cost summation method, plays an essential role in AFM funds control. Through the coordination of the CNO staff, the AFM budget does serve as a control tool for monitoring AFM expenditures which

closely coincides with the hierarchical structure which exists from the CNO level to the operating level.

b. Weaknesses

(1) Budget Development. Each Type Commander requires subordinate activities to submit a next quarter forecast of estimated AFM requirements as well as an estimate for the remainder of the fiscal year. These requests are broken down by organizational/intermediate maintenance levels, and include justification for the requested amounts. These reports are primarily used by management for the purpose of funds allocation and necessary redistribution of currently appropriated funds. They are not used for budget development purposes.

Aside from the historical costs which are collected and forwarded to the CNO, the Type Commanders do not solicit budget proposals from lower echelons in their command. The AFM funds control system, thus does not provide for, or require, involvement by subordinates in goal setting or in the budget process. The AFM budget is based on the cost-per-hour for aircraft type, and projected flight hours. Computations performed at the CNO and staff assistant level are made without input from lower echelon commands. The result is a potential lack of goal congruence. Since there are no formal objectives for AFM funds management, there is no way of knowing whether the objectives of each unit coincide with the Type Commanders or whether the Type Commanders

objectives are even the same as the CNCs. The system discourages management incentives because the funding requirements are determined without dialogue with operating units. This lack of participation thereby reduces the level of budgetary understanding, removes any feeling of responsibility for the budget, and reinforces the generally held belief that if organizational AFM funds run short, additional funds will be supplied.

(2) Funds Allocation. To achieve efficient AFM funds management, administrators require a grant allocation system which is accurate and meaningful. Yet, the determination of AFM grants based upon projected base loading is an extremely inaccurate process. In reality, repair actions (AFM costs) are driven by many factors independent of base loading. These factors include; age of aircraft, proximity of aircraft to scheduled depot level maintenance (SDLM), aircraft configuration changes, technical directive compliance, supporting intermediate maintenance activity repair capability, maintenance for transient aircraft, operating environment, and operations schedule. Additionally, AFM funds are not provided for aircraft which are not in a flying status. These aircraft, although "down", still incur some maintenance costs and may return to a flying status at any time. These "down" aircraft are also subject to cannibalization actions (inter aircraft transfer of parts or components) which further increases their maintenance costs. To arrive at an accurate

projection of AFM costs all of these factors would have to be taken into consideration (Braman, 1984).

An additional problem which compounds the inaccuracy of the base loading algorithm is that AFM costs tend to lag considerably behind the on-aircraft repair action. This funds expenditure lag is particularly true at the intermediate repair level where failed component repair actions may occur weeks or months after the item has been removed from the aircraft. This widely varying time lag reduces the correlation of AFM funds allocation to base loading.

The inherent inaccuracy of the base loading algorithm results in inaccurate AFM funds allocation that may require force wide adjustments during the course of the year (especially during the third and forth quarters) and increases the likelihood of inefficient funds expenditure. That is, the correct amount of AFM fund allocation is unlikely to occur, resulting in excess funds being awarded (the funds manager feeling compelled to spend all monies granted), or a funding shortfall (necessary maintenance actions not completed). Also it is reasonable to assume that operational units discount the integrity of the budget due to these inaccuracies. Since operational units are not held directly responsible for AFM funds management and since monies are distributed on the basis of past requirements, it is difficult for Type Commanders to determine whether managers are efficiently managing funds.

(3) Cost Collection. An accurate cost base is necessary to improve the management, distribution, and budget justification of AFM funds. Successful AFM management depends upon accurate cost collection as well as an understanding by supply, maintenance, and financial personnel of the importance, methods, and intents of AFM cost collection. Efforts to improve AFM allocation methodology, management, budget surveillance, and up-line budget justification, depend greatly on AFM charges accurately reflecting applicable type and ownership.

The need for improvement in this area is compounded by the great increase in AFM transactions which will result from the migration of AV-DLRs into the Navy Stock Fund. The Type Commanders have long recognized the problems associated with AFM cost collection, and have made efforts to resolve the problem. The following list of problem areas were provided by the Type Commanders.

1. No Job Order Number (JON) standardization between Naval Air Stations (NAS) exists.
2. Few NASs totally comply with established procedures.
3. In most Intermediate level activities, AFM direct (to aircraft TEC) costs are not traceable to benefitting organizations.
4. Transient aircraft are frequently incorrectly reported.
5. A multitude of methods for handling non-aircraft direct charges exists, most are inappropriate.
6. Training of fleet personnel in job order accounting is greatly needed.

Since the Type Commanders must account for their budget by aircraft type it is important that the obligation and the reporting of dollars spent be differentiated by type equipment code (TEC). Cost differentiation can present a problem when equipment is used for more than one aircraft type, as it is difficult to determine which aircraft type to bill. Miscellaneous TECs have been used as a solution to this problem. The obligated funds charged to these miscellaneous TECs are eventually spread out among the aircraft types. While this proration procedure is necessary for cost distribution it is the opinion of the Type Commanders as well as previous AFM studies, i.e., Audit Report C17010 and Bozin [Ref. 2], that this excessive proration of AFM costs softens critical historical cost data, resulting in weakened up-line AFM cost justification and down-line historical cost-based allocation and spending surveillance, and can be reduced. It is unlikely that long term correction of the problem can be achieved without an increased level of cost assignment standardization.

(4) Relative Size and "limitless pot syndrome". In the AFM research of Reily and Sheppard (1980), and Bozin [Ref. 2], two budget related factors were identified which affected AFM funds management, these two factors are also pertinent for this study. They are: (1) the fact that AFM funds comprise only a small percentage of the total aviation O&M,N maintenance budget (Reily, 1980); and (2)

the existence of a "limitless pot syndrome" (COMNAVAIRLANTINST 7310.5H, 1983) and [Ref. 2].

Reily observed that, while the cost of operating and maintaining the Navy's fleet of aircraft is substantial, the majority of operating expenses financed from the O&M,N appropriation (on the order of 70-80%) are incurred in funding flight operations (i.e., aviation fuel). Further, since refinements or savings in AFM funds expenditures might not be expected to cause significant reductions in overall aviation operations and maintenance costs, the temptation exists for the congress, as well as for Navy AFM funds managers, to accept the current management practices for these funds. However, under the stock funding of AV-DLRs the AFM component of O&M,N will expand to where AFM funds will exceed the flight operations component by a factor of three to one in FY 1986 (Dillenburg, 1984).

Bozin [Ref. 2] identified a general perception among operational AFM funds managers that AFM funds need not be closely controlled. This perception was based upon a belief that if budget projections are exceeded, additional funds could always be obtained from the fund custodians. This observation is validated by COMNAVAIRLANT in their 1983 instruction 7310.5H. It states, "The general perception that AFM funds are unlimited and `free' is invalid." Bozin referred to this as the "limitless pot syndrome". He describes the situation,

> "... if a squadron gets close to exceeding its budget, it requests a supplement. Type Commanders by reducing future quarterly grants of other squadrons who are safely below their budget, can increase the original squadrons allotment to meet their potential over expenditure. The same process can be repeated at the next higher level in the chain of command, if an entire NAS is in danger of going over budget." [Ref. 2: pp. 51-53]

This ability to redistribute funds exists because excesses have been built into the budget. While this procedure for dealing with contingencies may be viewed by some as sound management practice, it reinforces the belief of subordinate units that AFM funds need not be used effectively and efficiently. The "limitless pot syndrome" is not conducive to efficient AFM expenditure. Since the stock funding of AV-DLRs assumes a user recognition of AFM resource scarcity, this perception presents a significant problem for this new system.

4. Information System

As discussed earlier, for management control to be effective, a systematically organized and developed processing and reporting system is required. An information system should facilitate comparisons of results, uncovering deviations from standards, and guide the way to corrective action. Information must flow both up and down the chain of command.

a. Strengths

The Type Commanders utilize a well developed formal reporting system which is well suited to its environment. The system adequately communicates necessary information for the monitoring of subordinate progress toward the on-schedule

expenditure of grants. The formal reporting structure among the various command levels in the administrative chain provide the Type Commanders with much information. The centralized cost collection system links cost summation data despite type aircraft diversity and aircraft location dispersion. The information system allows the Type Commanders to monitor expenditure activity of the units under their control.

b. Weaknesses

Both COMNAVAIRLANT and COMNAVAIRPAC have directives which include instructions for the submission of periodic accounting reports and detail forms of information feedback. However, reporting procedures and formats are not consistent between subordinate units. That is, aircraft carrier financial reporting is directed to the FAADCs in the form of the BOR (a copy is provided to the Type Commander). On the other hand, the shore stations financial reporting is directed to the Type Commanders and they must report in the form of the FHCR. Because these two reports are submitted to different commands, the required content and submission dates are also different. These content and timing differences complicate the information feedback process in that the Type Commanders provide input funds to aircraft carriers yet their obligation reporting is directed to the FAADC.

Reports received by the Type Commanders provide information necessary for monitoring expenditures. However, information necessary for a comparison of planned and actual

performance is not provided as required by a management control system. There is very little performance information feedback provided to operational units. Although the Type Commanders do notify units when reports are significantly in error, little feedback regarding the quality of information is provided. This lack of feedback prevents Commanding Officers from making AFM expenditure performance appraisals of their units.

5. Performance Appraisal

Performance appraisal provides information on the status of organizational activities. It serves three purposes for management: (1) it provides feedback regarding performance; (2) it is a basis for modifying or changing behavior to meet organizational objectives; and (3) it is a basis to assign incentives or rewards.

a. Weakness

The concept of responsibility accounting is a method of relating expenditures to the people responsible for incurring the expenses. It is based upon the theory that the official who exercised the highest authority level of an organization should be accountable for the expenses which are under his control. As previously described no performance standards are established, therefore it is not surprising that there is a lack of formal Type Commander appraisal, (e.g., fitness report input, of subordinate units commanding officers regarding performance in the management

AFM dollars or flight hour costs). This absence of accountability leaves little incentive for the Commanding Officer to ensure AFM funds are used efficiently.

6. Motivation

Information in reports does not by itself lead to desired actions. Action depends upon how managers react to information. Their reaction to information depends upon their motivation.

a. Weakness

The AFM control system is a mechanical process which fails to consider factors important in motivating subordinate managers to take desired actions. In order for any control system to be effective, the personnel working within its structure must support and reinforce it. Currently there is no positive reinforcement which would encourage subordinate managers to be efficiency minded. In fact, the one motivation that does exist has an undesired effect. That is, there is a common perception that a failure to spend all available funds which are provided will result in a commensurate reduction in following fiscal years.

C. SUMMARY

Readiness is the stated goal of the Type Commanders and readiness is perceived to be the output which results from the input of AFM resources. Because readiness is an output which is difficult to measure, it is not possible to state with certainty whether the systems objectives are

being achieved. However, from the preceding analysis it is apparent that the thrust of the AFM funds control system is directed toward insuring that AFM expenditures do not exceed legal ceiling limits. Because the scope of the control system is limited to this fiduciary accountability orientation it does not possess the fundamental elements which have been identified as central to good management control, and therein lies the source of the previously cited weaknesses. However, it should be noted that within the narrow context of its intended design, the system has proven to be adequate to its objective. Yet, it is evident that this one-dimensional control perspective does little to facilitate efficient or effective funds usage. Therefore, this study's evidence supports the findings of previous researchers, (i.e., Reily and Sheppard (1980) and Bozin [Ref. 2], in that the existing AFM funds control system requires a more comprehensive approach to control. This study's findings further suggest that the impending implementation of AV-DLRs (with its emphasis on cost control) will tend to exaggerate existing weaknesses in the system.

VI. MANAGEMENT CONTROL SYSTEM RECOMMENDATIONS

A. GENERAL

Prior to discussing possible management control enhancements, it should be recognized that aircraft maintenance actions which generate AFM expenditures tend not to be discretionary. Funds are obligated to accomplish the maintenance of aircraft and the repair of failed aircraft components and must be viewed, for the most part, as driven costs. A substantial risk exists in pressuring operational funds managers to reduce AFM obligations (costs). Type Commander initiatives into the area of efficiency must be carefully reviewed and implemented so as to ensure that desired results would be attained from any system changes. That is, constraining the obligation of AFM funds may result in the undesired affect of motivating operational funds managers to reduce or defer necessary maintenance in order to achieve goals or standards. This dysfunctional response would create a long term undesired impact upon aircraft readiness which would be extremely difficult to correct.

Although aircraft maintenance costs are generally not considered to be discretionary, the necessity for a well planned, management control system to ensure that subordinate resource expenditure decisions are made with efficiency and effectiveness in mind, is not diminished. Moreover, the advent of the stock funding of AV-DLRs brings with it

a substantial portion of maintenance costs that will exhibit a variable nature, i.e., an approximate 60 percent price savings will result from the return of components which are determined to be beyond the capability of maintenance (BCM). In this environment keen management control could significantly reduce AFM costs.

B. RECOMMENDATIONS

A key incentive for the transition to stock funding for AV-DLRs has been given as the expectation of improved supply system discipline resulting from increased cost awareness in the buyer-seller relationship which it establishes. This cost awareness, which is inherent in the stock fund environment, will replace todays "free issue" procedure (Draft Imp.). The authors of stock funding system for AV-DLRs hypothesize that the two price system (standard and net), will motivate operational units to ensure that BCM components are expeditiously returned to the supply system for repair. This study proposes that this hypothesis is only valid if: (1) the "limitless pot" syndrome, as addressed in Chapter V, is overcome, and (2) the Type Commanders have a management control system which is capable of measuring, analyzing, and evaluating subordinate performance. That is, unless operational units believe that AFM funds are indeed a scarce resource, and unless the Type Commanders institute a control system which monitors compliance with directives and motivates subordinates to improve the use of resources, the expected

benefits of AV-DLR stock funding may not be realized. The transition to stock funding of AV-DLRs may afford the Type Commanders an unique opportunity for the implementation of a total management control system. In fact, the overall success of the AV-DLR stock funding effort may largely depend upon the installation of a management control system which emphasizes efficiency and effectiveness.

Based upon the preceding, it is recommended that the Type Commanders implement a management control system which would operationally coincide with the 1 April 1985 start of the stock funding of AV-DLRs. The following sequence of actions are suggested in the establishment of the system: (1) establish performance standards, (2) develop control tools, (3) construct an information system, and (4) institute formal performance appraisal.

1. Performance Standards

In Chapter II it was stated that organization goals and objectives provide for management decision making and form the basis for the development of performance standards which are critical to the management control process. This study, as well as previous AFM studies, has found "readiness" to be the stated goal of the Type Commanders, and that "readiness" is perceived to be the output generated from AFM cost inputs. However, because "readiness" is difficult to measure, it provides no clear cut objective function that can be used in analyzing alternative courses of action,

and there is no accurate way of estimating the relationship between input and output. Because "readiness" is not readily quantifiable there is difficulty in measuring performance and it is impossible to estimate how much "readiness" should be attained from a given amount of AFM cost. The principles of management control suggest that in the absence of adequate output measures of performance, some type of surrogate output measure must be substituted. If a direct measure of output can not be found then input cost may be used as a proxy output measure. Although generally less desirable than a true output measure, costs are better than no measure at all. In the case of AFM the Type Commanders have recognized the difficulty in relating AFM expenditures to "readiness" and have resorted to the use of inputs (AFM costs) as a form of performance measurement. However, no standards have been developed for these costs and therefore variance analysis is not possible. Instead actual expenses are compared to budgeted allowances, suggesting a spending limit orientation rather than true performance appraisal.

The Chapter III discussion of AFM budget development described a process where the AFM budget submission to the CNO consisted of historical cost data by aircraft type per flight hour. Upon arrival at the CNO level this data was combined with projected flight hours to derive a projected budget requirement. In Chapter V it was noted that the Type Commanders utilize a methodology of funds allocation

to operational units which is based upon a base loading algorithm, not flight hours. It is assumed that this incongruity between the funding and allocation process results from a difficulty in quantifing factors which drive AFM costs and in relating these costs to funds allocation. In fact, as stated previously the Type Commanders believe that factors other than flight hours affect the expenditure of AFM funds i.e., age of aircraft, aircraft configuration changes, technical directive changes, AIMD repair capability. If these variables, which in addition to flight hours affect AFM expenditures, can be predicted as previously discussed, then these cost estimation equations would be useful for AFM funds allocation. Additionally, this type of statistically derived budget data would provide substantial budget justification. Simple statistical techniques may also prove useful in the establishment of performance measurement indices as well as for budget development and allocation. The following methodology is proposed as a guide in the development of these performance standards.

a. Data Collection

Historical AFM costs are available for all aircraft under the purview of the Type Commanders. A twelve month average AFM cost for a type model series aircraft over a significant base period, (5-10 years) should be developed on a fiscal year basis. The base year range should be sufficiently large enough to represent a sufficient base of historical

cost but at the same time a judgement must be made as to the relevance of the historical data. In order to identify any atypical data, the use of a scatter gram is recommended. Outlying data points should be considered for exclusion. It should be noted that this averaging assumes sufficient cost data for each aircraft type to generate a representative cost base which would reflect a valid average cost.

b. Data Adjustment

In order for this averaged cost data to be useful it must be internally consistent and comparable. Hence, before estimating procedures can be derived, an adjustment must be made for yearly price changes. Adjustments are made by means of a price index constructed from a time-series of data in which one year is selected as the base and the value for that year expressed as percentage of this base. The other remaining years are then expressed as a percentage of this base. As an example the AFM cost for a given aircraft type for FYs 1979 to 1984 could be converted to an index using any of the years as the base.

To construct simple indexes where c_n indicates the AFM cost per aircraft type per flight hour in the given period and c_o indicates the cost in the base period, the general formula for the simple index, or cost relative, is:

$$I_c = \{c_n \backslash c_o\} \times 100$$

Similarly, where q_n indicates the quantity of flight hours during the given period and q_o indicates the quantity in the base period, the general formula for the simple quantity index, or quantity relative, is:

$$I_q = \{q_n \backslash q_o\} \times 100$$

Finally, the value of a commodity in a designated period is equal to the cost commodity multiplied by the quantity produced. Therefore, $q_n c_n$ indicates the value of a commodity in the given period, and $q_o c_o$ indicates the value of the commodity in the base period. The general formula for a simple value index, or value relative, is:

$$I_v = \{q_n c_n \backslash q_o c_o\} \times 100$$

c. Regression Analysis

As previously discussed in Chapter III AFM costs are measured on the basis of flight hours, (i.e., AFM cost rate = AFM cost/flight hour). However, while the number of flight hours certainly affects AFM costs, Type Commander personnel admit that the two are not directly proportional. They have suggested that additional variables affect AFM funds expenditure, (e.g., age of aircraft, frequency of flights, AIMD repair capability). The technique of regression analysis could be used to determine the correlation (r) between these independent variables and AFM cost. If a strong correlation exists using one or more of these variables, then regression analysis could be a tool for the development of performance standards.

The primary objective of regression analysis is to predict the value of one variable (the dependent variable) given that the value of the associated variable(s) (the independent variable) is known. One cannot expect to be able to forecast or predict the exact value of the dependent variable, as there are many factors that may cause variations in the dependent variable for a given value of the dependent variable. Because of these possible variations the regression equation describes the average relationship between the dependent variable and the independent variable(s) (Kazmier, 1976).

Because of the nature of financial problems, the independent variable(s) (in this case age of aircraft, operating environment, etc.) are intuitively interpreted as causal factors affecting the amount of the dependent variable (AFM cost). The term simple regression analysis indicates that the dependent variable is predicted on the basis of one independent variable (as would be the case if flight hours were directly proportional to AFM costs), where as multiple regression analysis is concerned with predicting the dependent variable on the basis of two or more independent variables. The technique of regression analysis can be thought of as consisting of two distinct stages. The first, consisting of estimating the constant (the fixed component of AFM costs) and coefficients if the equation (curve fitting or variable costs), and the second

is that of inferring the reliability and significance of the results of the estimate on the basis of assumed properties possessed by the data and the results (Batchelder, 1969).

In reality, the regression analysis does not establish the cause and effect relationship. Tests of significance of parameter estimates (standard error), goodness of fit (coefficient of determination r^2) and correlation (correlation coefficient r) must also be established. Regression analysis merely provides a numerical measure of the significance of the relationship, but once a regression equation is formulated, then it can be used to estimate the value of the dependent variable (AFH cost) given the value of the independent variable(s). In other words, the development of this regression equation would provide a standard cost for a given level of activity. This standard cost could then be used as a starting point for evaluating efficient resource usage.

The calculations required for determining the values of the constants in a regression equation and the associated standard error values can be complex and time consuming, and are beyond the scope of this thesis. However, computer programs are widely available to the Type Commanders to carry out such calculations.

2. Control Tools

Control tools have been defined as mechanisms used to collect and organize data, feed it to the decision maker,

and facilitate comparisons with predetermined standards. In this non-profit organization the budget is the key control tool for management. In order to effect beneficial change, it is the budget and related processes which hold potential. It is proposed that improvement in three aspects of control tools should be considered, they are: budget development, grant allocation, and behavioral considerations.

a. Budget Development

This study has indicated that while AFM funds managers having R.S. 3679 responsibility will certainly need to provide for monitoring of legal spending limitations, the current philosophy of relying upon fiduciary accountability as the sole control mechanism is inadequate for facilitating efficient funds expenditure. Since fiduciary accounting is required by law and is functional, it can not be abandoned. It should instead be regarded as the foundation for a more comprehensive management control system. If the budget is truly developed as a standard and not just an upper limit on spending then deviations may justifiably be anticipated on either side of the standard. As deviations from the norm are encountered, corrective action as necessary may be taken to restore the balance. The view of the AFM budget as merely an upper limit on spending, and not a standard, removes much of its benefit.

Although legal spending limits must be adhered to, this does not mean that Type Commanders must pass fixed budgets to subordinates. Bozin [Ref. 2: p. 26], points out,

> "The fact that the federal budget as passed by congress originates as a ceiling limit does not mean that budgets used to allocate funds must be viewed as such throughout all levels of management. As allocations are made down the chain of command, these allocations should be constructed so that managers have a meaningful optimum at which to aim."

It is therefore proposed that flexible budgets be adopted. Using the cost estimating equation developed through regression analysis, flexible budgets could easily be constructed by the Type Commander for a projected activity level and assigned to operating units. The use of flexible budgets would eliminate unwarranted pressure on operational unit AFM funds managers who have have incurred unplanned AFM expenses from increased operations (or some other factor), but who must still remain within the ceiling constraint. By the same token, it would also reduce the opportunity for wasteful inefficiency in a unit which experiences reduced operations from what was planned.

b. Grant Allocation

It is recommended that the previously proposed cost estimating equation be applied to the AFM grant allocation process. By using this cost estimating relationship in conjunction with projected flight hours (or other variables) the allocation process would be much more accurate than

the base loading procedure currently employed. By providing the "correct" amount of funds to subordinate units, maintenance planning and AFM funds management would be enhanced. Because large third and fourth quarter funds redistribution would be eliminated, managers could have confidence in the budget figure provided by the Type Commander. Additionally, the opportunity for inefficient AFM funds expenditure would be reduced by a more accurate allocation procedure, as the theoretically correct amount of funds would be granted for a given activity level.

c. Behavioral Considerations

Any management control system which is proposed must be unobtrusive and represent minimal additional workload upon subordinate units. In order to find acceptance subordinate units must perceive that it will be of beneficial to them and not represent additional constraints or paperwork burden. The system must motivate subordinates to achieve desired results without excessive Type Commander monitoring efforts.

The current AFM budget formulation process, which is centralized at the CNC level, could be enhanced by input augmentation from subordinate levels. All levels of AFM managers should be afforded the opportunity to participate in the process. By their participation, AFM managers should gain a better understanding of the budget as well as attainment of a feeling of responsibility for it. It is also likely that the budget quality will be improved by this slight decentralization.

3. Information flow

The necessity of information flow in a management control system has been addressed. It has also been shown that the current system lacks both upward and downward communication flow. The information which the system provides must be of sufficient quality and quantity to assist managers in the conduct of their responsibilities. It also should be designed to assist in management by exception efforts when the control system has failed to keep the organization within the plan.

The problems caused by excessive use of prorating and miscellaneous cost allocation have been discussed. Although the Type Commanders are aware of this problem and acknowledge the necessity for proper cost assignment, no specific guidelines have been developed to clarify and standardize cost accumulation procedures. In consonance with previous AFM research, (i.e., Naval Audit Service 1981, Bozin, 1981), it is recommended that fleet wide procedures be developed to standardize cost collection practices. Additionally, standard rates for actual miscellaneous costs should be enforced. The establishment of target rates below the current levels should encourage managers to intensify efforts to properly assign costs and lead to more accurate AFM cost accounting and accurate cost standards.

4. Performance Appraisal

Performance appraisal should be conducted on both a organizational level as well as an individual level.

a. Organizational Appraisal

A comparison of AFM cost rates by aircraft type should be made between operating units. This practice would identify those units that exceed the norm and where they stand in relation to one another. This practice would highlight to Type Commander staff personnel, those units which may require management attention. Additionally, this publication of comparable data would likely foster a spirit of competition which would provide additional stimulus for cost efficiencies.

b. Individual Appraisal

Currently AFM managers are held accountable for nothing other than R.S. 3679 violations. This limitation on accountability provides little incentive for efficient management practices. Both Reiley and Sheppard (1980) and Bozen [Ref. 2] recognized the need to link AFM funds management to the performance appraisal of AFM funds managers. Their recommendation that this aspect be included in managers fitness reports is sound given that program goals and objectives have been previously defined and concurred in by all involved. This singular action if properly applied could have a significant impact on efficiency.

C. SUGGESTIONS FOR FUTURE STUDY

The previous research of Reily and Sheppard (1980) recommended relating AFM funds budget execution directly to aircraft readiness. As discussed previously, readiness is viewed by AFM funds managers as representing the ultimate output

measure of AFM cost input. However, because of the difficulty in quantifying readiness, and the numerous factors which affect readiness other than cost, this study has instead proposed the development of a cost equation which would express the relationship between AFM costs and its independent variable(s). In the development of this equation, correlations for each independent variable must be established. Therefore, it is suggested that research be conducted to evaluate this relationship between the dependent variable (AFM cost) and the various independent variables. If statistically significant correlations can be established, then budget development, budget allocation, and performance measurement tools, could easily be determined and updated from this straight forward and simple procedure.

If a statistically significant correlation for AFM costs can not be determined, then it is recommended that research be conducted to evaluate the potential for correlating AFM costs to the smaller sub-set of the AV-DLR component of AFM costs. This relationship would reduce the number of independent variables which would be considered as well focusing analysis upon the component of AFM costs which is most likely to exhibit the greatest variable cost nature. While the control advantage gained from this lessened scope would be reduced, the potential still exists for the establishment of management control principles for the majority of AFM funds.

Development of the regression analysis equation will require accurate historical input data. Discussions with Type Commander personnel reveals a skepticism regarding the availability of an accurate data base from which needed information can be drawn. It is suggested that the suitability of existing aircraft maintenance related data bases such as the aviation material maintenance management system (AV-3M), be reviewed for this purpose. Additionally, it is suggested that management information systems currently in the development phase (i.e., naval aviation logistics command management information management system (NALCOMIS)), be reviewed to ensure the inclusion of such data.

It is recommended that post stock funding research be conducted. In the event that a management control system as recommended by this study has been implemented prior to 1 April 1985, a comparison to the current system would be useful. If a management control system has not been adopted, post stock funding research should be conducted to validate or invalidate the findings of this study, which would lead to a reassessment of the need for a control system as suggested in this study.

D. SUMMARY

Two of the major conclusions of this study are that the basic orientation of the current AFM funds control system is oriented toward the monitoring and reporting of costs; and the existing system is inadequate to capitalize upon

the inherent cost efficiencies associated with the stock funding of AV-DLRs. While the need for remaining within authorized spending ceilings (fiduciary accounting) is unquestioned, the gap between the fiduciary accounting orientation of the current AFM funds control system and fundamental management control principles makes the outlook for more efficient and effective use of resources is unlikely.

If the decision is made to implement a management control system, an implementation plan must be developed. Because instituting change involves dealing with people, the manner in which change is instituted has a major impact on the way in which it is accepted. Attitudes toward a system are developed during its implementation. If negative attitudes are formed, or if there is poor understanding of how the system works or what it is suppose to achieve, then the effectiveness of the system will be impaired. Given proper implementation, a management control system for AFM funds based upon the principles detailed in this study, will result in more effective and efficient use of limited resources.

APPENDIX A

GLOSSARY OF ACRONYMS

AFM	AVIATION FLEET MAINTENANCE
AIMD	AVIATION INTERMEDIATE MAINTENANCE DEPARTMENT
APA	APPROPRIATION PURCHASES ACCOUNT
ASO	AVIATION SUPPLY OFFICE
AV-DLR	AVIATION DEPOT LEVEL REPAIRABLE
BCM	BEYOND THE CAPABILITY OF MAINTENANCE
BOR	BUDGET OPTAR REPORT
CNO	CHIEF OF NAVAL OPERATIONS
COMNAVAIRLANT	COMMANDER, NAVAL AIR FORCES, U.S. ATLANTIC FLEET
COMNAVAIRPAC	COMMANDER, NAVAL AIR FORCES, U.S. PACIFIC FLEET
CPH	COST-PER-HOUR
DLA	DEFENSE LOGISTIC AGENCY
DLR	DEPOT LEVEL REPAIRABLE
DOD	DEPARTMENT OF DEFENSE
DON	DEPARTMENT OF THE NAVY
FAADC	FLEET ACCOUNTING AND DISBURSING CENTER
FHCR	FLYING HOUR COST REPORT
FHP	FLYING HOUR PROGRAM
GAO	GOVERNMENT ACCOUNTING OFFICE
GSA	GENERAL SERVICES ADMINISTRATION
IMA	INTERMEDIATE MAINTENANCE ACTIVITY
MAG	MARINE AIRCRAFT GROUP

NAS	NAVAL AIR STATION
NARF	NAVAL AIR REWORK FACILITY
NAVCOMPT	COMPTROLLER OF THE NAVY
NSA	NAVY STOCK ACCOUNT
NSF	NAVY STOCK FUND
OB	OPERATING BUDGET
OMA	ORGANIZATIONAL MAINTENANCE ACTIVITY
OP-20	CNO FLYING HOUR PROGRAM BUDGET DOCUMENT
OPNAV	OFFICE OF THE CHIEF OF NAVAL OPERATIONS
OPTAR	OPERATING TARGET
OSD	OFFICE OF THE SECRETARY OF DEFENSE
O&M,N	OPERATION AND MAINTENANCE, NAVY
PCC	PRACTICAL COMPTROLLERSHIP COURSE
PE	PROGRAM ELEMENT
POM	PROGRAM OBJECTIVES MEMORANDUM
SECDEF	SECRETARY OF DEFENSE
SPCC	SHIPS PARTS CONTROL CENTER
TEC	TYPE EQUIPMENT CODE
TMS	TYPE MODEL SERIES

APPENDIX B

GLOSSARY OF TERMS

ALLOCATION - An authorization by a designated official of a component of the Department of Defense making funds available within a prescribed amount to an operating agency for the purpose of making allotments; i.e., the first subdivision of an apportionment.

ALLOTMENT - An authorization granted within and pursuant to an allocation for the purpose of incurring commitments, obligations, and expenditure in the accomplishment of an approved budget. Therefore, an allotment is a subdivision of an appropriation which proviaes the funding authority for an official to accomplish a specific function or mission.

APPORTIONMENT - A determination by the Office of Management and Budget as to the amount of obligations which may be incurred during a specified period under an appropriation, contract authorization, other statutory authorizations, or a combination thereof. An apportionment may relate either to all obligations to be incurred during the specified period within an appropriation account or to obligations to be incurred for an activity, function, project, object or combination thereof.

APPROPRIATION - An appropriation is an annual authorization by act of congress to incur obligations for specified purposes and to make payments out of the Treasury. Appropriations

are subdivided into budget activities, sub-heads, programs, projects, etc.

EXECUTION - The operation of carrying out a program as contained in the approved budget.

EXPENDITURE - A charge against available funds. They are evidenced by vouchers, claims, or other documents, approved by competent authority. Expenditures represent the actual payment of funds.

OBJECTIVE - A goal, expressed as that portion of the "what," "when," and "where," of a requirement which is reasonably feasible of attainment within the expected availability of resources of men, money, and technological capability.

OBLIGATION - The amount of an order placed, contract awarded, service rendered, or other transaction which legally reserves a specified amount of an appropriation or fund for expenditure.

PROGRAM ELEMENT - A description of a mission by the identification of the organization entities and resources needed to perform the assigned mission. Resources consist of forces, manpower, material quantities, and costs, as applicable. The program element is the basic building block for the Five Year Defense Plan (FYDP).

RESOURCE SPONSOR - The DCNO or Director of a Major Staff Office who, by organization charter, is responsible for determining program objectives, time-phasing and support requirements, and for appraising progress, readiness, and military worth for a given weapon system, function, or task.

REVOLVING FUND - A fund established to finance a cycle of operations to which reimbursements and collections are returned for re-use in a manner such as will maintain the principal of the fund, e.g., working capital funds (including stock funds and industrial funds), and loan funds.

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